

DIVISION OF ENVIRONMENT  
QUALITY MANAGEMENT PLAN

PART III:

STREAM CHEMISTRY MONITORING PROGRAM  
QUALITY ASSURANCE MANAGEMENT PLAN

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## Section 1

### INTRODUCTION

#### 1.1 Purpose of Document

This document presents the quality assurance (QA) management plan for the Kansas stream chemistry monitoring program. Quality assurance goals, expectations, organizational responsibilities, and program evaluation and reporting requirements are specifically addressed. Standard operating procedures (SOPs), describing sample collection, preservation, transport and analysis methods, equipment maintenance and calibration protocols, and other routine program activities, are provided in the appendices of the plan.

#### 1.2 Historical Background

The Kansas Department of Health and Environment (KDHE) and its predecessor agency, the Kansas State Board of Health, have together monitored the quality of the state's streams and rivers for more than a century. Early monitoring efforts, from the middle 1890s to the early 1920s, focused primarily on the sanitary condition of waterbodies serving as public water supplies and on the incidence of the typhoid bacterium (*Salmonella typhi*) in drinking water. These efforts were instrumental in the passage of several major sanitation and water pollution control statutes and contributed to a dramatic reduction in the incidence of typhoid fever in Kansas.

Intensive river basin surveys were performed on an episodic basis from approximately 1922 to 1978. These surveys entailed a considerable commitment of staff and other resources. By 1978, individual surveys involved as many as twenty agency employees and fifteen field vehicles, including three mobile laboratory facilities. Employees remained in the field for eleven days at a time. Two days were required for laboratory set up and field reconnaissance and an additional two for laboratory take down, leaving seven consecutive days for field monitoring purposes. Staff were assigned specific sample collection and/or analytical duties. Sampling crews were dispatched each morning from a central "field" location, normally a small hotel or a public park facility with electrical and water hook-ups for the mobile laboratories. Water samples were collected from several dozen streams within the basin. Also, samples of treated wastewater were gathered from discharging sewage treatment plants, and semi-quantitative studies of benthic macroinvertebrate communities were performed at the stream chemistry monitoring locations (see stream biological program QA management plan).

Water and wastewater samples collected during the basin surveys were transported to the mobile laboratory facilities near the middle of each work day and analyzed for total suspended solids, total hardness, pH, total and phenolphthalein alkalinity, calcium, magnesium, biochemical oxygen demand (BOD), dissolved oxygen (DO), chloride, and total coliform, fecal coliform and fecal streptococcus bacteria. Additional samples were preserved in the field and ultimately transported to the KDHE environmental laboratory in Topeka, where they were analyzed for turbidity, specific

conductance, nutrients (ammonia, nitrate, total phosphorus), selected alkaline earth and alkali metals (sodium, potassium, magnesium, barium), selected transition metals and metalloids (total recoverable arsenic, cadmium, copper, iron, manganese, mercury, selenium, silver and zinc and hexavalent chromium), polychlorinated biphenyls, phenols, and selected pesticides and pesticide degradation products (e.g., 2,4-D, 2,4,5-T, 2,4,5-TP, aldrin, alpha-BHC, atrazine, dacthal, DDE, DDT, dieldrin, endrin, heptachlor, heptachlorepoxyde, lindane, methoxychlor, sencor, toxaphene).

From 1956 to 1961, the Kansas State Board of Health also collected water samples on a monthly basis from a network of 39 "permanent" stream monitoring stations. Almost all of these stations were located on major rivers, and many were located immediately downstream of large federal reservoirs. Grab samples were collected from bridges and analyzed for most of the inorganic parameters mentioned previously. In 1961, the agency entered into a cooperative agreement with the United States Geological Survey (USGS), an agency that had independently conducted water quality monitoring in the state from 1945 to 1960. This agreement created a joint state/federal network consisting of 67 monitoring stations. The terms of the agreement were such that most analytical work was conducted by the Kansas State Board of Health, whereas most field work and report writing activities were conducted by USGS. This cooperative program continued to evolve over the next decade. In 1967, approximately 35 "interstate" monitoring stations were added to the network and sampled on a bimonthly basis for most routine inorganic and bacteriological parameters. Approximately 37 "interior" monitoring stations were added to the network in 1973. Samples were collected from these stations on a monthly basis and analyzed for most of the inorganic, organic and bacteriological parameters mentioned previously.

The Kansas stream chemistry monitoring program underwent several major changes in October 1975. Specifically, the cooperative agreement with USGS was discontinued; all sample collection and analysis activities and data interpretation/report writing functions were transferred to KDHE; the number of monitoring stations in the network was reduced from approximately 140 to 115; and the collection of transition metal and pesticide samples was implemented at all stations. The monitoring program continued with essentially no further modification until April 1990. At that time, the number of permanent monitoring sites in the network increased to 148 and samples began to be collected on a bimonthly (rather than monthly) schedule. Nearly 140 "rotational" monitoring stations also were added to the sampling network. Water samples were collected from a given rotational station only one year out of every four years (i.e., about one-fourth the total number of rotational sites were sampled, on a bimonthly basis, in any given year). In all, approximately 175 monitoring stations, permanent and rotational, were sampled in any given year. The addition of these new stations in 1990 allowed the agency to obtain a much broader geographical perspective on water quality conditions within the state (see Figure 1.2-1). Also, the placement of many of these stations on smaller order streams facilitated a more thorough analysis of rural and agricultural impacts on surface water quality.

From 1990 to 1995, several additional parameters were added to the list of monitored substances. Examples included fluoride, nitrite, ortho-phosphate, antimony, molybdenum and thallium. This expansion in the number of parameters was made possible through the procurement of new analytical instrumentation by the KDHE laboratory (KHEL). Examples of such instrumentation included an ion chromatograph, an intercoupled argon plasma emission spectrometer, and more

sophisticated gas chromatographs and mass spectrometers. The microbiological parameters, fecal coliform bacteria and fecal streptococcus bacteria, were monitored at all permanent and rotational stations.

From 1995 to 2000, the inclusion of additional ecoregional reference sites and watershed integrator sites increased the number of permanent monitoring stations in the network to 158. The number of rotational sites increased to 148, primarily to accommodate the ongoing development and implementation of total maximum daily loads (TMDLs). These TMDL activities, and the Governor's Water Quality Initiative (1996-1998) and several other special studies, required more frequent (biweekly or monthly) collection of samples from selected sites around the state. In 1999, the monitoring program added mercury to the routine analyses and discontinued fecal streptococcus bacteria analyses.

From 2000 to 2005, the stream chemistry monitoring program continued to evolve by adding four chemical parameters (Kjeldahl nitrogen, total organic carbon, strontium, and hexachlorocyclopentadiene), two microbiological parameters (*E. coli* and enterococci) and ten radiological parameters (actinium-228, cesium-136, cobalt-57, gross uranium, iodine-132 and 133, neodymium-147, strontium-89 and 90, and total solids) and by collecting chlorophyll *a* samples from selected monitoring stations (see section 4.4.2). The program discontinued two parameters (fecal coliform bacteria and biochemical oxygen demand) during this same period. Additional analytical instrumentation was procured by KHEL, including an inductively coupled plasma mass spectrometer for metal analyses, a new ion chromatography unit for anion analyses, and a new flow chemistry analyzer for total Kjeldahl nitrogen, ammonia, and total phosphate analyses. Additional ecoregional reference sites and watershed integrator sites increased the number of active permanent monitoring stations in the network to 165. The number of rotational sites increased to 153.

Recent efforts to improve the program have focused largely on quality assurance/quality control (QA/QC) and data management issues. In 2000, field container blanks and field-matrix spikes were implemented in an attempt to ascertain the combined effects of sample preservation, transportation, storage (containment), laboratory preparation, matrix interferences and other aspects of the water collection and analysis process on reported pollutant concentrations. In 2002, a data collection application, accessed in a Palm operated pen-notepad handheld computer, provided the platform for a unified lab number for all samples (inorganic, organic, bacteriological, radiological) collected from a single monitoring station. This handheld computer incorporated a bar code data capture technology that prevented the transposition of bottle numbers by field staff and eliminated data discrepancies associated with the manual lab data entry process. Historically, to accommodate the transfer of data into the Kansas Water Database (KWB) storage format, the laboratory data files with chemical and bacteriological analyses were electronically linked together by station, date, and time using Office of Information Technology (OIT) in-house conversion programs. However, this affiliation scheme was prone to transcription errors (misinterpretation of handwritten field collection sheets and/or data entry error) resulting in incomplete data transfers to the KWB. Now, for the first time, all of the physicochemical and microbiological measurements from a given monitoring station could be linked together by a single laboratory accession number, thereby insuring the complete transfer of this information to the laboratory database and KWB. Other benefits of the electronic tracking included: enhanced recording of all ancillary data (e.g., flow conditions and other field

observations); greater flexibility to change scheduled QA/QC field activities; and an improved capacity to validate the completeness of the results reported by the laboratory.

In 2002, KDHE began replacing its IBM AS-400 mainframe computer with a Xiotech storage area network (SAN) and Hewlett Packard server-based system with Oracle client/server operating software. This conversion was deemed necessary to better harmonize with several federal databases (e.g., modern Storage and Retrieval (STORET) system) now operating on an Oracle database platform. By mid 2002, KDHE had purchased the new computer system, initiated the setup process, and completed the necessary in-house training. Testing of this new system was completed by the end of the year. In January 2003, OIT staff successfully migrated a portion of the stream chemistry monitoring data (1986-2003) to Oracle. By March 2003, KDHE was operating dual server platforms, updating both Oracle and the IBM AS-400 systems with stream chemistry data transferred directly from the laboratory's database. These simultaneous updates were performed until December 2003 when the IBM AS-400 system update was discontinued.

Utilizing the new software tools and programming knowledge gained in the test production of the new Oracle server system, OIT programming staff developed a water quality data evaluation program in late March 2003. This program generated outlier warning reports on a station-by station and parameter-by parameter basis by automatically comparing newly acquired data to the historical database and flagging any value that (a) exceeded the historical maximum value, (b) extended more than 2.0 standard deviations beyond the historical mean concentration, or (c) exceeded the established 95th percentile concentration. In December 2003, with technical input and guidance from BEFS data management staff and the stream chemistry program manager, OIT staff began developing a second-stage data validation system that performed 12 distinct QA/QC checks to accept, qualify or reject data for inclusion in the KWB and, ultimately, the modern STORET database system. This mathematically intensive application became fully functional in June 2004. It incorporated algorithms for checking cation:anion balances, total dissolved solids (TDS), specific conductance ratios, and elemental concentrations versus constituent concentrations (e.g., total phosphorus versus ortho-phosphate-P). In July 2004, additional constituent ratio calculations were added (e.g., sodium/chloride, specific conductance/sulfate). These additional ratio checks revealed physicochemical signatures for each of the state's water quality monitoring stations. Armed with this knowledge, new data could now be compared to historical, station-specific constituent ratios to identify and flag potential field and analytical mistakes resulting from the application of erroneous dilution factors, misinterpretation of laboratory analytical instrumentation, switching of field and/or laboratory sample bottles, collection of water from the wrong stream locations, and other factors. All flagged calculations are now presented in the warning portion of the outlier/warning report. Once flagged, the suspect data are evaluated by the program manager and verified, corrected or discarded, as appropriate (see section 4.9.2).

During the 2003 Session of the Kansas Legislature, K.S.A. 2002 Supp. 82a-2001 was amended to effectively redefine the meaning of "classified stream" and to create new subclasses of both primary and secondary contact recreational use (KDHE 2005c). In addition, the revised water quality standard for primary contact recreation was now based on *Escherichia coli* (*E. coli*), a single species in the fecal coliform group, with a numeric criterion concentration predicated on a geometric mean derived from at least five separate samples collected in separate 24-hour periods during a 30-day

assessment period. Prior to this change in statute (July 1967 through June 2003), KDHE had assessed sanitary degradation relative only to measured concentrations of fecal coliform bacteria. In July 2003, the stream chemistry monitoring program was compelled by upper management to discontinue the routine monitoring of fecal coliform bacteria and substitute *E. coli* as the principal indicator organism for assessing the sanitary conditions of the state's rivers and streams. In 2004, the program initiated a new bacteriological project that met the aforementioned (geometric mean-based) requirements, with an initial focus on the Arkansas and Kansas rivers. Concurrently, a special comparative study was initiated to measure enterococci levels, chloride concentrations, and specific conductance along with *E. coli* to determine which indicator organisms would afford the most robust measure sanitary condition in waters of higher salt content.

In 2006, the stream chemistry monitoring program implemented a statewide geometric mean-based (GMB) monitoring program for *E. coli* that adheres to a five-year (basin-by-basin) rotational schedule consistent with current TMDL and NPDES permit development activities. Two rotational sites were added to the network in the Spring River subbasin to support ongoing TMDL activities, increasing the total active rotational sites to 155. The permanent sites remained at 165. Currently, the stream chemistry monitoring program network is comprised of 324 permanent and rotational sites (Figure 1.2-1).

Contemplated for several years, a probabilistic stream monitoring program was initiated in 2006 to complement the department's existing water quality monitoring and assessment programs (see KDHE 2005a). Staff from the traditional (targeted) stream monitoring program play a support role in obtaining physicochemical data from randomly selected stream reaches near existing targeted monitoring stations. Data from the probabilistic program will be used to ascertain the state's overall level of compliance with the provisions of the Kansas surface water quality standards for 305(b) reporting purposes. This approach will allow the department to produce unbiased estimates of use support for the state as a whole, with accompanying measures of statistical confidence (see stream probabilistic monitoring program QA management plan).

### 1.3 Contemporary Program Objectives

The stream chemistry monitoring program endeavors to provide timely and scientifically defensible information on the physical, chemical and bacteriological condition of flowing waters in Kansas. This information is intended for use in:

- (1) complying with the water quality monitoring and reporting requirements of 40 CFR 130.4 and sections 106(e)(1), 303(d), 305(b), and 319(h) of the federal Clean Water Act;
- (2) evaluating waterbody compliance with the provisions of the Kansas surface water quality standards (K.A.R. 28-16-28b *et seq.*);
- (3) identifying point and nonpoint sources of pollution contributing most significantly to documented water use impairments;

- (4) documenting spatial and temporal trends in surface water quality resulting from changes in prevailing climatological conditions, land use and land cover, natural resource management practices, wastewater treatment plant operations, and other phenomena;
- (5) developing scientifically defensible environmental standards, wastewater treatment plant permits, and waterbody/watershed pollution control plans and TMDLs; and
- (6) evaluating the effectiveness of pollution control efforts and waterbody remediation/restoration initiatives implemented by the department and other natural resource agencies and organizations.

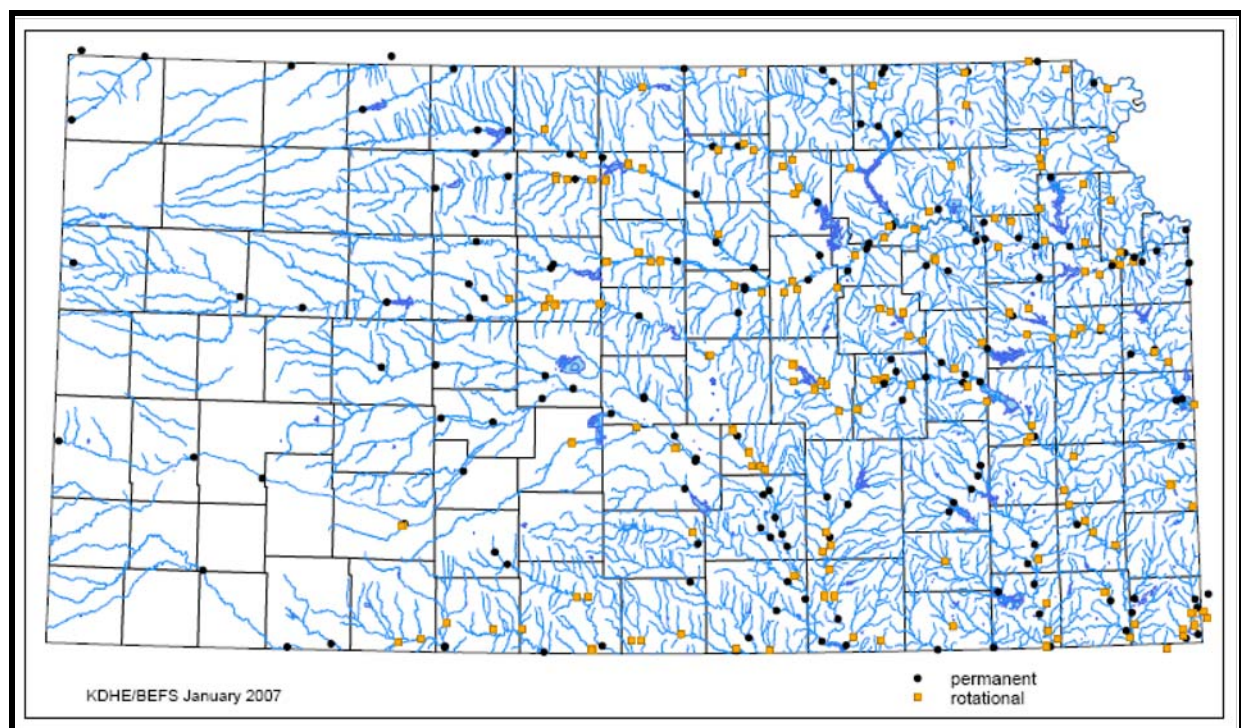


Figure 1.2-1. Current distribution of permanent and rotational stream chemistry monitoring stations.

## **Section 2**

### **QUALITY ASSURANCE GOALS AND EXPECTATIONS**

The foremost goal of this QA management plan is to ensure that the Kansas stream chemistry monitoring program produces data of known and acceptable quality. "Known quality" means that data precision, accuracy, completeness, comparability and representativeness are documented to the fullest practicable extent. "Acceptable" means that the data support, in a scientifically defensible manner, the informational needs and regulatory functions of the Bureau of Environmental Field Services (BEFS), the Division of Environment, and the agency. The success of the program in meeting this general goal is judged on the basis of the following data performance criteria and requirements:

- (1) Where practicable, the reliability of program data shall be documented in a quantitative fashion. For routine water chemistry parameters, the precision of data shall be evaluated through the use of duplicate samples and the accuracy of data shall be evaluated through the use of field blanks and field spiked samples. The average relative percent difference (RPD) among duplicate samples shall, for all parameters, be less than twenty percent; spike recoveries shall average between 80 and 120 percent of the actual spike concentrations; background contaminant levels (determined through the analysis of field blanks) shall constitute, on average, less than ten percent of the reported sample concentrations.
- (2) Loss of physicochemical and microbiological data due to sample collection, transport or analytical problems, or to the subsequent mishandling of data, shall be limited to less than five percent of the data originally scheduled for generation. Where problems occur and a substantial quantity of data is lost, an effort shall be made to resample the stream(s) in question to maximize data completeness.
- (3) Changes in the methods used to obtain and analyze surface water quality samples shall be carefully documented through formal revisions to the standard operating procedures (SOPs) appended to this QA management plan. This requirement is intended to help maintain a reasonably consistent database over time, enhance knowledge of the effects of any procedural changes on reported contaminant concentrations, and facilitate the identification and evaluation of long-term trends in surface water quality.
- (4) Data generated through this program shall be compared and contrasted with other available monitoring data to examine the representativeness of program findings relative to other reported results. Staff shall attempt to ascertain the probable causes of any discrepancies observed between the various existing databases and describe, in end-of-year program reports, the magnitude and practical significance of such discrepancies.

## Section 3

### QUALITY ASSURANCE ORGANIZATION

#### 3.1 Administrative Organization

The stream chemistry monitoring program is one of several statewide environmental monitoring programs administered by the Technical Services Section, Bureau of Environmental Field Services (see QMP, Part II, BEFS QA Management Plan). Program offices are located in the Curtis State Office Building, 1000 SW Jackson St., Suite 430, in Topeka, Kansas.

#### 3.2 Staff Responsibilities

Program staff include one environmental scientist and three environmental technicians, and all affiliated with the BEFS Technical Services Section. The environmental scientist serves as the program manager and is accountable for most program planning, data interpretation, and report writing activities. This employee also monitors program QC, appraises the section chief of any equipment needs or staff training needs, and participates in the annual review and revision of the program QA management plan (see section 5).

Two environmental technicians are responsible for most traditional field activities, including nearly all sample collection, preservation, transport and chain-of-custody (sample documentation) functions. Other duties include the routine maintenance of field equipment, the scheduling of laboratory services, and the review and verification of laboratory data prior to transfer to the Kansas Water Database and United States Environmental Protection Agency (EPA) STORET database (section 4.8). Staff of the BEFS Northwest District Office (operating out of Hays, Kansas) and the Southwest District Office (operating out of Dodge City, Kansas) also participate in the program by collecting samples from streams in the westernmost region of the state (Appendix B). Occasionally, personnel from other BEFS programs may assist with stream chemistry sampling activities, especially in the event of staff absences or when additional people are needed to conduct work in a timely, safe and efficient fashion. Staff of the stream chemistry monitoring program provide reciprocal assistance to these other programs.

The third environmental technician is responsible for nearly all sample collection, preservation, transport and chain-of-custody (sample documentation) functions in the statewide geometric mean-based (GMB) *E. coli* monitoring program. Other duties include the routine maintenance of field equipment, the scheduling of laboratory services, and the review and verification of laboratory data prior to transfer to the Kansas Water Database and EPA STORET database (section 4.9).

#### 3.3 Staff Qualifications and Training

Minimum technical qualifications for program staff vary by position. The program manager must hold at least a four-year college degree in environmental chemistry, environmental microbiology,

aquatic biology, hydrology or a related scientific field and have substantial experience in the performance of water quality studies and associated data analysis and statistical procedures. The program manager must also understand the basic principles of supervision, program administration and quality control and possess advanced computer skills and written and oral communication skills. Also, pursuant to Part I of the divisional quality management plan (QMP), the program manager must complete formal supervisory training offered by the Kansas Department of Administration and quality assurance training offered by EPA. The program's environmental technicians (and all other employees routinely assisting with this program) must command a thorough understanding of the procedures used in the collection, handling and preliminary analysis of surface water samples and in the processing of associated paperwork and other documentation. The environmental technicians travel extensively throughout the state, observing and obtaining samples from literally hundreds of streams. Hence, these individuals perform a valuable reconnaissance function and must be proficient in the visual identification and recognition of severe water quality problems warranting follow-up investigation and/or an emergency remedial response.

Individuals routinely participating in this program must possess a valid Kansas driver's license and current certifications in first aid, cardiopulmonary resuscitation (CPR), and the use of automated external defibrillators (AEDs). They must review the program's QA management plan and SOPs prior to assuming field/laboratory duties and repeat this review at least annually (QMP, Part I). All program staff receive in-house training in applicable work procedures and related safety requirements. As funding and other agency resources allow, the program manager and environmental technicians are encouraged to participate in technical workshops and seminars dealing with environmental monitoring operations and related field, analytical, data management and statistical procedures.

## Section 4

### QUALITY ASSURANCE PROCEDURES

#### 4.1 Monitoring Site Selection

The monitoring program's network of permanent and rotational stations is designed around the objectives set forth in section 1.3 of this document. Specifically, an effort is made to evaluate water quality conditions in each of the state's major physiographic, geological and land use regions (objectives 1, 2 and 4) while providing data on individual waterbodies needed to identify major sources of contaminants (objective 3), develop scientifically defensible permits, pollution control plans and/or TMDLs (objective 5), and assess the effectiveness of implemented pollution control and remediation efforts (objective 6). In selecting individual stations for inclusion (or retention) in the monitoring network, the following questions are posed:

- (1) Would the candidate station materially enhance the spatial coverage of the monitoring network? That is, would the location coincide with a region of the state or a major river basin currently under represented in the network?
- (2) Would the candidate station reflect water quality conditions throughout the entire watershed or stream segment, or would local phenomena (e.g., channelization projects, point sources, area cropping practices, livestock access, riparian deforestation) create water quality conditions unrepresentative of the watershed or stream segment as a whole?
- (3) Would the candidate station afford long-term access to the stream for monitoring purposes? Could access be curtailed at the discretion of a private landowner or limited during periods of heavy precipitation and/or high stream flow?
- (4) Does historical water quality data exist for the candidate site? If so, does the available database provide a reliable indication of historical water quality conditions?
- (5) Does other, ancillary data exist for the candidate site? Does the site coincide with any ongoing hydrological or biological data collection activities (e.g., KDHE stream biological monitoring station; USGS stream gaging station)?
- (6) Would the candidate station provide water quality data of unique interest? For example, does the site represent an unusually pristine location, suitable for use as a long-term ecoregional reference location? Does the stream segment potentially constitute an outstanding national resource water or a critical habitat for any state or federally listed threatened or endangered species? Is the candidate site located on an interstate stream in the vicinity of the state boundary, thereby constituting a potential interstate stream monitoring station?

Temporary monitoring stations also may be added to the network to support special studies conducted by KDHE or other cooperating agencies. Participation in such studies is ultimately contingent on the availability of staff and other resources. All monitoring stations, whether temporary, rotational or permanent, are subject to the same site documentation requirements: longitude and latitude are precisely determined through the use of global positioning system (GPS) techniques (see SOP No. SCMP-001); photographs are taken of all monitoring locations and periodically updated to track changes in the physical character of the monitoring sites; and narrative descriptions of the monitoring locations are prepared and maintained on a computer database to facilitate site identification/verification by new monitoring personnel and interested members of the general public.

## 4.2 Field Protocols

### 4.2.1 Sample Collection

The Kansas stream chemistry monitoring network is conveniently divided into ten sampling routes or "runs." Program personnel perform one or two runs each week, or the entire set of runs every two months, thereby accommodating the bimonthly sampling schedule described in section 1.2. Half of the network runs are completed in a single day. The five remaining runs, which cover larger expanses of land and are farther removed from Topeka, require three days to complete. The monthly GMB monitoring runs involve streams that exhibited elevated levels of *E. coli* during routine (single-sample) monitoring operations or special studies conducted or commissioned by the department during the prior year. Geometric mean-based monitoring is performed at these sites on a seasonal basis (i.e., four times annually). All program staff work closely with KHEL analysts to schedule sampling runs well ahead of time and ensure that the laboratory is prepared to receive incoming samples. Typically, staff inform KHEL of analytical needs at least two months in advance of a sampling run. Prior to each scheduled sampling run, the electronic run sheet (Run Template A or B, see Appendix C) is populated with the appropriate site descriptors, laboratory accession numbers (supplied by the KHEL lab), and names of the participating field staff. This template is re-saved as a network run file (e.g., Northeast Run; May 27, 2005), uploaded onto a Palm data collection application, correctly structured using a Microsoft Excel analyzer add-in tool, and accessed in the field on a handheld computer.

A full-sized van with special safety accommodations is utilized for most field work with alternate vehicles (lease, rental, and district vehicles) used in network support activities or special studies commissioned by the department (Appendix A). Upon arrival at a monitoring station, flashing warning lights are engaged and the field vehicle is parked on the shoulder or far side of the road (rural areas) or in a nearby parking lot (urban areas). Staff activate the handheld computer and access the site information including station number, location, lab accession number, field date, bottles to be scanned, temperature, pH, flow conditions, and collector names. They then begin the barcode scanning process by directing the scanner beam onto the designated bottle barcodes for the station's entire suite of sample bottles. Each barcode label has a two-letter code at the end of the four digit number to insure the correct scanning of bottles (i.e., cubitainer "CM," total organic carbon "TC," trace metal "HM," dissolved oxygen "DO," nutrient "NT," bacteria "BC," pesticide "OC," rad health "RD," and tritium "TT"). After scanning the last bottle of the set for the station, staff enter the current date and time using an automated entry procedure (see SOP No. SCMP-013).

Upon completion of the above procedures, staff approach the bridge on foot wearing fluorescent orange safety vests or jackets. Water samples are collected from the comparative safety of the bridge deck with the aid of a rope and a specially fabricated and weighted stainless-steel bucket or, in the case of pesticide or radiological samples, a stainless-steel pail. Samples are collected from the downstream side of the bridge and from the apparent thalweg (the deepest appearing portion of the channel) to minimize entanglement with debris and resuspension of sediment. All samples are transferred to the field vehicle, where preliminary measurements are performed and recorded on the handheld computer along with any special comments. Samples are fractionated and preserved prior to delivery to KHEL, as discussed in sections 4.2.2, 4.2.3, 4.2.4 and 4.2.5, below.

#### 4.2.2 Special Sample Collection Circumstances

Personnel engaged in a given stream sampling run visit all the stations included in said run, unless emergency conditions dictate otherwise or alternative arrangements have been approved in advance by the stream chemistry program manager or the section chief.

Strict adherence to approved procedures may not always be possible due to safety considerations and varying field conditions (e.g., ice formation, woody debris accumulations, bridge repair work). If a bridge is not available, or if ice formation, shallow water or other conditions preclude collection of samples from a bridge, sampling personnel may attempt to access the stream from shore, within the road public right-of-way, or from private land if this can be done with the landowner's advance permission and without undue risk of personal injury or harm. Streams that are frozen over are sampled only if the ice cover can be safely broken using a concrete-weighted ice breaker provided for this purpose. Monitoring staff are not permitted to walk or drive on frozen streams during stream sampling or reconnaissance operations.

When collecting samples from shallow streams, care is taken not to disturb the stream bottom sediments and inadvertently increase levels of particulate material within the water sample. When some disturbance of the bottom sediments is unavoidable, the sample is collected and the questionable nature of the sample is recorded in the comments section of the reporting form accessed via the handheld computer.

In most cases, streams that are obviously pooled and completely lacking in flow are not sampled by program staff. When doubt exists as to the presence or absence of stream flow, a sample is collected and the questionable nature of the sample is recorded in the comments section of the reporting form. All improvisations required during the collection of a particular sample are documented on the handheld computer and on the backup field sheet under the remarks column (Appendix C).

Finally, when collecting water quality samples in streams known to contain live zebra mussels (*Dreissena polymorpha*), a dedicated rope for these sites is used and the weighted stainless-steel sample bucket and stainless-steel pail are subsequently double rinsed with demineralized water before moving to sites outside the known range of this invasive species.

#### 4.2.3 Sample Containers

Several types of samples are actually gathered by program staff, and each is transported and stored in its own specific kind of container with a barcode label that has a two-letter container code (Appendix B). The stainless steel bucket containing the sample is gently swirled between each of the poured fractions. The fraction reserved for physicochemical determinations is ultimately transferred to a new one-quart plastic cubitainer; the aliquot reserved for the total organic carbon bottle is transferred to a 125-ml amber glass bottle; the aliquot reserved for trace metal analysis is transferred to a new certified acid-washed 250-ml Nalgene bottle; the aliquot reserved for the dissolved oxygen bottle is transferred to a 200-ml glass bottle; the aliquot reserved for the nutrient analysis is transferred to a new 250-ml amber Nalgene bottle; the aliquot reserved for the bacterial analysis is transferred to an autoclaved 125-ml polyethylene bottle. The remaining portion of the sample provides water for pH and temperature measurements. Pesticide samples are transferred from the stainless steel pail to a one-gallon dark glass bottle with a Teflon-lined plastic cap. Radiological samples are transferred to a one-gallon polyethylene jug, except for the tritium sample fraction which is transferred to a 100-ml glass bottle. Duplicate chlorophyll *a* samples are transferred to one-quart plastic cubitainers.

#### 4.2.4 Sample Preservation

Methods employed in the preservation of stream water samples are described in detail in Appendix B. In summary, mineral, nutrient, total organic carbon, pesticide and bacteriological samples are stored in the dark, on ice, pending transfer to KHEL; chlorophyll *a* samples are likewise stored on ice and in darkness pending transfer to the BEFS lab. Trace metal sample bottles and radiological sample jugs supplied by KHEL are pre-acidified with nitric acid, whereas nutrient sample bottles are pre-acidified with sulfuric acid and total organic carbon bottles are pre-acidified with phosphoric acid. Dissolved oxygen samples are analyzed by KHEL using the Winkler titration technique and are preserved in the field vehicle using appropriate additions of manganous sulfate, alkaline potassium iodide azide, and concentrated sulfuric acid (APHA 1998); once the sulfuric acid is added, the dissolved oxygen samples are stored in a deeply shaded area of the field vehicle pending transfer to KHEL (Appendix B). Chlorophyll *a* samples must be filtered within 72 hours of collection. Filters are stored at the BEFS laboratory in a freezer pending extraction and analysis, and a maximum holding time of 15 weeks is applied to all frozen filters, analyses are conducted at the BEFS lab in the Curtis State Office Building in Topeka (see lake and wetland program QA management plan).

#### 4.2.5 Preliminary Measurements

Temperature is measured to the nearest °C using a Fisher model #15-0778 stainless-steel dial scale thermometer, which is placed directly in a 50-ml beaker following transfer of the sample to the field vehicle. pH measurements are performed on the same 50-ml sample aliquot using a Cole Parmer model #5996-70 portable pH meter or comparable instrument. All measurements are recorded on the handheld computer and the field recording sheet along with other pertinent information (see Appendix B).

#### 4.3 Sample Transport, Chain-of-Custody and Holding Times

All samples must be handled and stored in a fashion which minimizes contamination, leakage and damage during transport. Samples collected during one-day sampling runs are delivered to KHEL that same day, prior to the close of business. Samples gathered on three-day sampling runs are delivered to the laboratory on the last day of the sampling run, prior to the close of business. In the event field staff are unavoidably detained, every effort is made to contact KHEL by telephone to arrange for the late afternoon or evening transfer of samples. As a rule, no sample arrives at KHEL later than 72 hours after collection. Only those samples collected during three-day runs and submitted for dissolved oxygen (DO), turbidity, *E. coli* bacteria, nitrate, nitrite and/or ortho-phosphate analysis routinely exceed the maximum holding times established by KHEL. Quality control studies conducted by BEFS have shown no short-term holding time effect for DO once the samples are acidified. However, reported concentrations of some parameters such as fecal coliform and *E. coli* bacteria, nitrate, nitrite and ortho-phosphate may be somewhat less than actual ambient levels owing to bacteriological die-off, microbial assimilation of phosphorus and nitrogen, or other processes occurring within the samples. The magnitude of any change in concentration is ascertained through the use of field spikes (section 4.6.6) or through special QC (time-course) studies conducted by BEFS and KHEL.

A standardized electronic sample submission (chain-of-custody) form accompanies all samples submitted to KHEL and assigns each sample a unique lab accession number to insure the correct tracking and processing of samples and analytical information (Appendix C). The form also identifies sampling location, date and time of sample collection, flow conditions and other field observations, personnel involved in the collection of the sample, and analytical parameters of interest. Staff involved with the collection and transfer of samples sign and date two copies of the sample submission form. Employees of KHEL sign both forms, record the date and time, and retain one form to acknowledge receipt of samples and return the other to the delivering field staff. This basic sign-off procedure also is performed if the sample changes hands prior to arrival at KHEL (e.g., when district staff transfer samples to program staff; see Appendix B).

#### 4.4 Analytical Procedures Performed by BEFS Program Staff

##### 4.4.1 pH Analyses

pH measurements are performed in the field with a Cole-Parmer portable pH meter and combination electrode. The meter is standardized using pH 4.0, 7.0 and 10.0 buffer solutions traceable to the National Institute of Standards and Technology (NIST). Once standardized, and between each measurement, the electrode is rinsed thoroughly with demineralized water. After use, the barrel and bulb of the electrode are carefully rinsed with demineralized water, and a storage cap containing pH 4.0 buffer is fitted over the end of the electrode (Appendix B).

##### 4.4.2 Chlorophyll *a* Analyses

At designated monitoring stations, staff collect duplicate cubitainers for chlorophyll *a* and pheophytin *a* analyses and also record on the handheld computer and sample collection form the

estimated periphyton cover (filamentous algae) growing on the stream bottom. Selecting a cross-section of the streambed, either upstream or downstream of the sampling point, staff visually estimate the percent cover of filamentous algae (e.g., < 5% “none,” > 5% but < 33% as “low,” > 33% but < 67% as “moderate,” > 76% as “high”) growing on the underwater substrate (i.e., not the typical brownish diatom scum on rocks) within an area five meters on either side of the cross-section. The cubitainers containing the samples are placed on ice pending arrival at the BEFS laboratory, where they are refrigerated until ready for processing.

Samples are filtered within 72 hours of collection through a Gelman (Type A/E) glass-fiber filter. Filters are folded, wrapped in a paper blotter, labeled, packed in plastic bags with desiccated dry-rite compound, and placed in a freezer. After a minimum of three weeks of freeze-drying, the filters are pulverized in 90 percent acetone using a tissue grinder. The pulverized material is centrifuged, and the decanted, clarified extract is transferred to a quartz cuvette and measured spectrophotometrically for chlorophyll *a* and pheophytin-*a* content (APHA, 1998).

#### 4.5 Laboratory Analytical Parameters and Procedures

Analytical methods employed by KHEL and associated parameter reporting limits are summarized in tables 4.5-1 through 4.5-6, below.

TABLE 4.5-1

#### ROUTINE INORGANIC AND COMPOSITE CHEMICAL PARAMETERS

CONSTITUENT OR PHYSICAL PROPERTY	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD	HOLDING TIME
Alkalinity, total (as CaCO <sub>3</sub> )	20	mg/L	APHA 2320B	14 days
Aluminum, total recoverable	0.05	mg/L	EPA 200.7	6 months
Ammonia, total (as N)	0.10	mg/L	EPA 350.1	28 days
Antimony, total recoverable	0.05	mg/L	EPA 200.7	6 months
Arsenic, total recoverable	1	F g/L	EPA 200.8	6 months
Barium, total recoverable	0.02	mg/L	EPA 200.7	6 months
Beryllium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Boron, total recoverable	0.05	mg/L	EPA 200.7	6 months
Bromide	0.02	mg/L	EPA 300.0	28 days
Cadmium, total recoverable	1	F g/L	EPA 200.8	6 months
Calcium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Chloride	0.40	mg/L	EPA 300.0	28 days
Chromium, total recoverable	1	F g/L	EPA 200.8	6 months

Cobalt, total recoverable	0.01	mg/L	EPA 200.7	6 months
Copper, total recoverable	1	F g/L	EPA 200.8	6 months
Dissolved oxygen	0.1	mg/L	EPA 360.1	Immediate
Fluoride	0.15	mg/L	EPA 300.0	28 days
Hardness, total (as CaCO <sub>3</sub> )	calculated	mg/L	APHA 2340B	N/A
Iron, total recoverable	0.01	mg/L	EPA 200.7	6 months
Kjeldahl nitrogen	0.1	mg/L	EPA 351.1	28 days
Lead, total recoverable	1	F g/L	EPA 200.8	6 months
Magnesium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Manganese, total recoverable	0.005	mg/L	EPA 200.7	6 months
Mercury, total	0.5	F g/L	EPA 245.2	13 days
Molybdenum, total recoverable	0.02	mg/L	EPA 200.7	6 months
Nickel, total recoverable	1	F g/L	EPA 200.8	6 months
Nitrate (as N)	0.1	mg/L	EPA 300.0	48 hours
Nitrite (as N)	0.05	mg/L	EPA 300.0	48 hours
pH (field)	0.1	pH unit	APHA 4500-H <sup>+</sup>	Immediate
Phosphate, ortho- (as P)	0.25	mg/L	EPA 300.0	48 hours
Phosphorus, total (as P)	0.02	mg/L	EPA 365.1	28 days
Potassium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Selenium, total recoverable	1	F g/L	EPA 200.8	6 months
Silica, total recov. (as SiO <sub>2</sub> )	0.11	mg/L	EPA 200.7	28 days
Silver, total recoverable	1	F g/L	EPA 200.8	6 months
Sodium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Specific conductance	35	umhos/cm	APHA 2510B	28 days
Strontium, total recoverable	0.1	mg/L	EPA 200.7	6 months
Sulfate	0.5	mg/L	EPA 300.0	28 days
Thallium, total recoverable	0.05	mg/L	EPA 200.7	6 months
Total dissolved solids	calculated	mg/L	USGS I-1751-85	N/A
Total organic carbon	0.5	mg/L	APHA 5310B	28 days
Total suspended solids	10	mg/L	EPA 160.2	7 days

Turbidity	0.15	NTU	APHA 2130B	48 hours
Vanadium, total recoverable	0.005	mg/L	EPA 200.7	6 months
Zinc, total recoverable	0.005	mg/L	EPA 200.7	6 months
Temperature (field)	1	degrees C.	APHA 2550 B	Immediate

TABLE 4.5-2

ROUTINE ORGANIC PARAMETERS

CONSTITUENT OR PHYSICAL PROPERTY	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD	HOLDING <sup>1</sup> TIME
Acetochlor	0.1	F g/L	EPA 608	7 days
Alachlor	0.1	F g/L	EPA 608	7 days
Aldrin	0.025	F g/L	EPA 608	7 days
Atrazine	0.3	F g/L	EPA 608	7 days
Butachlor	0.5	F g/L	EPA 608	7 days
Carbofuran	0.5	F g/L	EPA 608	7 days
Chlordane	0.2	F g/L	EPA 608	7 days
Cyanazine	0.5	F g/L	EPA 608	7 days
DCPA	0.05	F g/L	EPA 608	7 days
p,p'-DDD	0.04	F g/L	EPA 608	7 days
p,p'-DDE	0.02	F g/L	EPA 608	7 days
p,p'-DDT	0.1	F g/L	EPA 608	7 days
Dieldrin	0.05	F g/L	EPA 608	7 days
Endosulfan I	0.02	F g/L	EPA 608	7 days
Endosulfan II	0.02	F g/L	EPA 608	7 days
Endosulfan sulfate	0.1	F g/L	EPA 608	7 days
Endrin	0.1	F g/L	EPA 608	7 days
alpha-BHC	0.025	F g/L	EPA 608	7 days
beta-BHC	0.05	F g/L	EPA 608	7 days
delta-BHC	0.05	F g/L	EPA 608	7 days
gamma-BHC	0.025	F g/L	EPA 608	7 days

Heptachlor	0.02	F g/L	EPA 608	7 days
Heptachlor epoxide	0.02	F g/L	EPA 608	7 days
Hexachlorobenzene	0.1	F g/L	EPA 608	7 days
Hexachlorocyclopentadiene	0.1	F g/L	EPA 608	7 days
Methoxychlor	0.2	F g/L	EPA 608	7 days
Metolachlor	0.25	F g/L	EPA 608	7 days
Metribuzin	0.1	F g/L	EPA 608	7 days
PCB-1016	0.5	F g/L	EPA 608	7 days
PCB-1221	1	F g/L	EPA 608	7 days
PCB-1232	0.5	F g/L	EPA 608	7 days
PCB-1242	0.5	F g/L	EPA 608	7 days
PCB-1248	0.5	F g/L	EPA 608	7 days
PCB-1254	0.5	F g/L	EPA 608	7 days
PCB-1260	0.5	F g/L	EPA 608	7 days
Picloram	0.8	F g/L	EPA 615	7 days
Propachlor	0.25	F g/L	EPA 608	7 days
Propazine	0.3	F g/L	EPA 608	7 days
Silvex, as acid (2,4,5-TP)	0.4	F g/L	EPA 615	7 days
Simazine	0.3	F g/L	EPA 608	7 days
Toxaphene	2	F g/L	EPA 608	7 days
2,4-D, as acid	0.8	F g/L	EPA 615	7 days
2,4,5-T, as acid	0.4	F g/L	EPA 615	7 days

<sup>1</sup>Pesticide samples must be extracted within 7 days of collection and analyzed within 40 days of extraction.

TABLE 4.5-3

NONROUTINE ORGANIC COMPOUNDS

CONSTITUENT OR PHYSICAL PROPERTY	REPORTING <sup>1</sup> LIMIT	REPORTING UNIT	ANALYTICAL METHOD	HOLDING <sup>2</sup> TIME
Chlorophyll-a	N/A	F g/L	APHA 10200 H	72 hours
Chlorpyrifos - Dursban	N/A	F g/L	EPA 608	7 days

Diazinon	N/A	F g/L	EPA 608	7 days
Deethylatrazine	N/A	F g/L	EPA 608	7 days
Desethylated atrazine	N/A	F g/L	EPA 608	7 days
Pheophytin-a	N/A	F g/L	APHA 10200 H	72 hours
Prometon	N/A	F g/L	EPA 608	7 days

<sup>1</sup>No reporting limit quantified levels are reported.

<sup>2</sup>Pesticide samples must be extracted within 7 days of collection and analyzed within 40 days of extraction.

TABLE 4.5-4

ROUTINE RADIOLOGICAL PARAMETERS

CONSTITUENT OR PHYSICAL PROPERTY	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD	HOLDING TIME
Actinium-228	11	pCi/L	RM021	5 days
Antimony-125	9	pCi/L	RM021	5 days
Barium-140	10	pCi/L	RM021	5 days
Beryllium-7	64	pCi/L	RM021	5 days
Cerium-141	8	pCi/L	RM021	5 days
Cerium-144	35	pCi/L	RM021	5 days
Cesium-134	5	pCi/L	RM021	5 days
Cesium-136	3	pCi/L	RM021	5 days
Cesium-137	7	pCi/L	RM021	5 days
Chromium-51	52	pCi/L	RM021	5 days
Cobalt-57	3	pCi/L	RM021	5 days
Cobalt-58	4	pCi/L	RM021	5 days
Cobalt-60	3	pCi/L	RM021	5 days
Gallium-67	30	pCi/L	RM021	5 days
Gross Alpha	1	pCi/L	EPA 900.0	5 days
Gross Beta	4	pCi/L	EPA 900.0	5 days
Gross Uranium	1	pCi/L	EPA 908.0	5 days
Indium-111	3	pCi/L	RM021	5 days

Iodine-123	10	pCi/L	RM021	5 days
Iodine-131	5	pCi/L	RM021	5 days
Iodine-132	3	pCi/L	RM021	5 days
Iodine-133	3	pCi/L	RM021	5 days
Iron-59	8	pCi/L	RM021	5 days
Lanthanum-140	9	pCi/L	RM021	5 days
Manganese-54	4	pCi/L	RM021	5 days
Molybdenum-99	23	pCi/L	RM021	5 days
Neodymium-147	12	pCi/L	RM021	5 days
Neptunium-239	11	pCi/L	RM021	5 days
Niobium-95	7	pCi/L	RM021	5 days
Potassium-40	88	pCi/L	RM021	5 days
Radium-226	87	pCi/L	RM021	5 days
Ruthenium-103	3	pCi/L	RM021	5 days
Ruthenium-106	27	pCi/L	RM021	5 days
Silver-110m	4	pCi/L	RM021	5 days
Strontium-89	1	pCi/L	RM021	5 days
Strontium-90	1	pCi/L	RM021	5 days
Technetium-99m	3	pCi/L	RM021	5 days
Thorium-228	1760	pCi/L	RM021	5 days
Total Solid	1	pCi/L	EPA 900.0	5 days
Tritium	350	pCi/L	EPA 906.0	5 days
Ytterbium-169	7	pCi/L	RM021	5 days
Zinc-65	8	pCi/L	RM021	5 days
Zirconium-95	6	pCi/L	RM021	5 days

TABLE 4.5-5

ROUTINE BACTERIOLOGICAL PARAMETERS

CONSTITUENT OR PHYSICAL PROPERTY	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD	HOLDING TIME
<i>E. coli</i> , Quantitray	variable	MPN/100 ml	APHA 9223B	24 hours <sup>1</sup>

<sup>1</sup>KDHE Stream Chemistry Program adopted an extended holding time due to logistical (sample transport) issues.

TABLE 4.5-6

NONROUTINE BACTERIOLOGICAL PARAMETERS

CONSTITUENT OR PHYSICAL PROPERTY	REPORTING LIMIT	REPORTING UNIT	ANALYTICAL METHOD	HOLDING TIME
Enterococci, Quantitray	variable	MPN/100 ml	ASTM D6503-99	24 hours <sup>1</sup>

<sup>1</sup>KDHE Stream Chemistry Program adopted an extended holding time due to logistical (sample transport) issues.

#### 4.6 Internal Procedures for Assessing Data Precision, Accuracy, Representativeness and Comparability

##### 4.6.1 In-house Audits

The section chief generally audits field and laboratory personnel, systems and procedures on annual basis. These actions may include system audits, consisting of qualitative, onsite reviews of QA systems and physical facilities for monitoring, measurement and calibration, or performance audits, during which quantitative assessments are made of the bias (accuracy) and variability (precision) of analytical measurements. During system audits, staff responsible for sample collection and field operations are required to demonstrate a proper understanding of the requirements imposed by the QA management plan and accompanying SOPs. During performance audits, staff are required to conduct field measurements in the presence of the section chief and to report measured values for temperature and pH that fall within five percent of the values established by the section chief. Should these values fall outside control limits, the section chief and participating staff initiate corrective actions as described in section 4.8.

##### 4.6.2 Instrument Calibration and Standardization

At semi-monthly intervals, the performance of thermometers used in the field is checked against a reference thermometer traceable to the National Institute of Standards and Technology (NIST). Before leaving for the field, monitoring staff also are expected to calibrate the pH meter and test the instrument for normal operation. The pH meter is standardized in the field, immediately prior to use, using NIST-traceable pH buffer solutions (Appendix B). This instrument must meet all

manufacturer performance specifications. Should the meter be found to drift significantly, more frequent calibrations are performed or corrective action procedures are invoked (section 4.8.1).

#### 4.6.3 Field Blanks

The possibility of sample contamination during sample preparation, handling, storage and analysis is assessed through the use of field blanks prepared with glass distilled water (inorganic analyses) or demineralized water (organic analyses) and subjected to the same treatment as surface water samples. (Contamination is an especially important consideration when sampling for trace metals and metalloids, as ambient concentrations of these parameters are often less than 1.0 Fg/L, and sample concentrations may be greatly augmented through exposure to airborne particulate matter, etc.). On each sampling run, or on at least one run during any week of sampling, the weighted stainless-steel bucket is filled under field conditions with glass distilled water initially meeting ASTM Type-I specifications. The water (blank sample) is transferred to a complete set of randomly selected sample containers and subjected to the same preservation, handling, storage and analysis procedures as the actual field samples. This procedure is repeated using the stainless steel pail and demineralized water to prepare field blanks for the organic parameters (Appendix B). If the limits for sample contamination presented in section 2, paragraph (1) are exceeded, corrective actions are implemented in accordance with section 4.8.2, below.

#### 4.6.4 Container Blanks

Bottles used to transport and store sample fractions cannot be regarded as clean and uncontaminated without some form of empirical verification. This is true even when new bottles are used or when reusable bottles have undergone extensive cleaning and preparation. Such bottles can (and sometimes do) contribute to imprecision and bias in the environmental data collection process. Container blanks provide an indication of the potential chemical, radiological and/or microbiological contamination resulting from sample containment. On a monthly basis, staff obtain a container of ASTM Type-I quality water from the KHEL inorganic laboratory. Prior to leaving the lab, this water (blank sample) is transferred directly to a complete set of randomly selected sample containers (or transported in the sampling vehicle and then poured directly into sample bottles under field conditions) and subjected to the same preservation, handling, storage and analysis procedures as the actual field samples (Appendix B). If the limits for sample contamination presented in section 2, paragraph (1) are exceeded, corrective actions are implemented in accordance with section 4.8.2, below.

#### 4.6.5 Field Duplicate Samples

Quality control measures implemented in the field also include the collection of sequential and concurrent duplicate (replicate) samples. Sequential duplicate samples (collected approximately five minutes apart) are obtained from a minimum of one station during each sampling run to assess variability among samples resulting from collection, processing, transport, and laboratory procedures. Concurrent duplicate samples are periodically collected by filling separate sample containers concurrently from the same sampling device to assess sample homogeneity (Appendix B). Should the precision of the data fall outside the control limits established in section 2, paragraph (1), corrective action procedures are invoked in accordance with section 4.8.3, below.

#### 4.6.6 Field Matrix Spiked Samples

At least six times each year, a set of spiked samples is prepared in the field under the direct supervision of the program manager through the addition of known concentrations of selected parameters to one of two or more replicate samples. Following laboratory analysis, measured levels of these parameters in the spiked samples are compared to those in the unamended samples to provide an overall indication of sample degradation and analytical recovery. Field spikes are prepared using high accuracy and high precision fixed- and adjustable-volume pipettes, volumetric glassware, and certified reference standards obtained from EPA, USGS, or appropriate commercial vendors (Appendix B). Should the accuracy of the data fall outside the control limits established in section 2, paragraph (1), corrective action procedures are invoked in accordance with section 4.8.3, below.

#### 4.6.7 Preventative Maintenance

Periodic inspection of sampling and analytical equipment and routine maintenance of this equipment is necessary to minimize malfunctions which could result in the loss of program data or disruption of program activities. Field instrumentation must routinely be inspected prior to use and calibrated at intervals recommended by the manufacturer. Equipment maintenance logs must be maintained for all field thermometers and pH meters. Vehicles used for field activities must be maintained in a reliable condition and kept free of trash, debris, tobacco products, or other materials that could significantly increase the risk of sample contamination (section 4.8.2). Entries must be made in the vehicle log upon completion of each field trip. Instrument and vehicle malfunctions must be reported to the program manager as soon as possible to expedite necessary repairs or the acquisition of new equipment (section 4.8.1).

#### 4.6.8 Safety Considerations

Attention to job safety protects the health and well-being of program staff and helps maintain a work atmosphere which ultimately enhances data quality and consistency. Program staff must be familiar with proper precautionary measures and the use of available safety equipment prior to assuming field duties. Each vehicle used in the stream chemistry monitoring program must be maintained in proper operating condition and equipped with a first aid kit, safety glasses, portable eye wash station, fire extinguishers, spare tire and tire changing equipment, rain gear, emergency road reflectors and/or flares, and at least one operable flashlight. A cellular phone is assigned to each monitoring vehicle and staff are directed to turn these on when in the vehicle so that communication can be maintained with the central office in the event of vehicle mishaps, medical problems, or other emergencies. The use of a cellular phone is especially important when conducting overnight sampling runs or when traveling alone or during periods of potentially severe weather. As an added safety feature when traveling in remote areas of the state, an automated external defibrillator (AED) was recently procured to provide aid in the event of cardiac emergencies; this lifesaving device guides the rescuer step by step through the entire rescue pending the arrival of trained medical personnel. All field staff must also exercise care when handling glassware and chemical reagents in the field. Chemicals reagents used in the field include manganous sulfate (eye and mucous membrane irritant), alkaline potassium azide iodide (oral toxin), concentrated sulfuric acid (strong acid and oxidizer), dilute sulfuric acid (skin, mucous membrane and eye irritant), nitric acid (strong

acid and oxidizer), and pH buffer solutions (eye and mucous membrane irritants). Staff should not engage in the use of these reagents or breakable glassware if the weather, terrain, traffic or any other concern impedes concentration, reduces visibility, jeopardizes footing, or otherwise precludes the safe handling of these materials. Rather, staff should move to a level, dry, protected, and well lighted area before preserving or analyzing samples. If the wind is blowing strongly, staff should avoid handling samples and reagents immediately upwind of their face and eyes. Additional safety considerations are presented in the SOPs accompanying this QA management plan.

#### 4.7 External Procedures for Assessing Data Precision, Accuracy, Representativeness and Comparability

At the discretion of the section chief, bureau QA representative or other administrative staff, the stream chemistry monitoring program may, from time to time, participate in independent audits or in cooperative, interlaboratory sample comparison programs or reference sample programs. Participation in such activities promotes scientific peer review and enhances the technical integrity and overall credibility of the program.

#### 4.8 Corrective Action Procedures for Out-of-Control Situations

##### 4.8.1 Equipment Malfunction

Any equipment malfunction discovered by staff during routine calibration/standardization activities or during an internal or external performance audit shall be recorded in the appropriate logchart and immediately reported to the program manager. The program manager is responsible for appraising the scope and seriousness of the problem and, if necessary, for determining whether the instrument should be repaired or replaced. The program manager also is responsible for ensuring that backup instrumentation is available for all critical field activities. Similarly, arrangements for a backup vehicle must be made in advance of any mechanical problems or mishaps that might render the primary vehicle inoperable for an extended period.

##### 4.8.2 Sample Contamination

Blank concentrations outside the control limits established in section 2, paragraph (1), detract from the quality and credibility of the stream chemistry data and must be resolved in a timely manner. In instances where the source of the contamination is unknown, the program manager shall conduct an investigation to determine whether the problem is of likely field or laboratory origin. Field contamination problems may result, for example, from improper sample collection technique or exposure to contamination sources at the sampling site or within the vehicle used to transport the samples. Laboratory problems may include contaminated water supply or reagents, contaminated glassware, or some less conspicuous problem. Program staff must work closely with KHEL personnel to identify and eliminate contamination sources. Persistent problems may trigger a program audit by the section chief and/or bureau QA representative and ultimately may result in the removal of questionable data from the stream chemistry database.

#### 4.8.3 Data Precision/Accuracy Problems

Should stream chemistry data fail to meet the precision and accuracy requirements of section 2, paragraph (1), the program manager must initiate an investigation to determine the cause of the problem. The program manager normally should work closely with KHEL to identify the cause and implement appropriate corrective measures. Persistent problems may trigger a program audit by the section chief or bureau QA representative, result in the disqualification of a substantial amount of stream water quality data, or invoke other remedial measures (e.g., independent audit).

#### 4.8.4 Staff Performance Problems

Should a member of the program staff have difficulty with a given work procedure (e.g., as determined by an internal performance audit), an effort must be made by the program manager to identify the scope and seriousness of the problem, to identify any data affected by the problem, and to recommend to the section chief an appropriate course of corrective action. All questionable data are either flagged within the computer database or, at the discretion of the section chief, deleted from the database. Possible corrective actions include, but are not necessarily limited to, further in-house or external training for the employee, a reassignment of work duties, or modification of the work procedure.

### 4.9 Data Management

The stream chemistry monitoring program routinely uses Oracle computer software to automatically perform 12 different QA/QC checks to generate data outlier/warning reports, water quality standards violation reports and summary statistics, and to graphically plot data for various combinations of sampling stations and regulated pollutants. Microsoft Visual Basic, Access, Excel, and PowerPoint are among the forms of software used to manage, share, and present the data. Environmental Systems Research Institute ArcView and ArcGIS software enable the program staff to prepare maps and provide visual presentations of various environmental distributional coverages. Desktop statistical and analytical graphic software packages such as Minitab, SAS JMP, and Systat SigmaPlot are used for performing statistical characterizations, comparisons and trend analyses.

#### 4.9.1 Data Check

All field- and laboratory-generated data are handled in an orderly and consistent manner (Table 4.9.1-1). Monitoring station identification number, lab accession number, time and date of sample collection, sample chain-of-custody, and other basic information is recorded on standardized electronic sample submission forms (Appendix C). Upon the delivery of samples to the laboratory receiving area, these forms are visually scanned for transcription errors or spelling errors, missing information. Recorded dates and times are reviewed for accuracy, lab accession numbers for consecutiveness, and bottle numbers for proper codes and correct scanning sequence. After this review, two copies are printed and again inspected for accuracy by program personnel. If any modifications, additions, or deletions are necessary, changes are completed electronically in the Excel file and saved. The Excel spreadsheet is then converted to a comma-delimited file and uploaded to KHEL's receiving computer using Palm OS procedure (SOP No. SCMP-013). In the event of failure in the transmittal or saving of this electronic information, the hand-written field

sheet completed by staff during the sampling run, serves as backup (Appendix C). Sampling staff and receiving laboratory personnel must sign and date both copies of the electronically generated form (or hand-written field sheet) in accordance with chain-of-custody procedures (SOP No. SCMP-006).

Upon completion of the laboratory analyses, the data is transferred using Open Database Connectivity (ODBC) and Oracle Heterogeneous Services software to integrate the KHEL SQL server data tables with the Oracle server data tables for transfer to the Kansas Water Database. Data files are processed and assigned a “datestamp” using in-house conversion programs to convert data from ASCII flat files to the Kansas Water Database storage format. The Kansas Water Database is supported and backed-up daily by the KDHE Office of Information Technology (OIT).

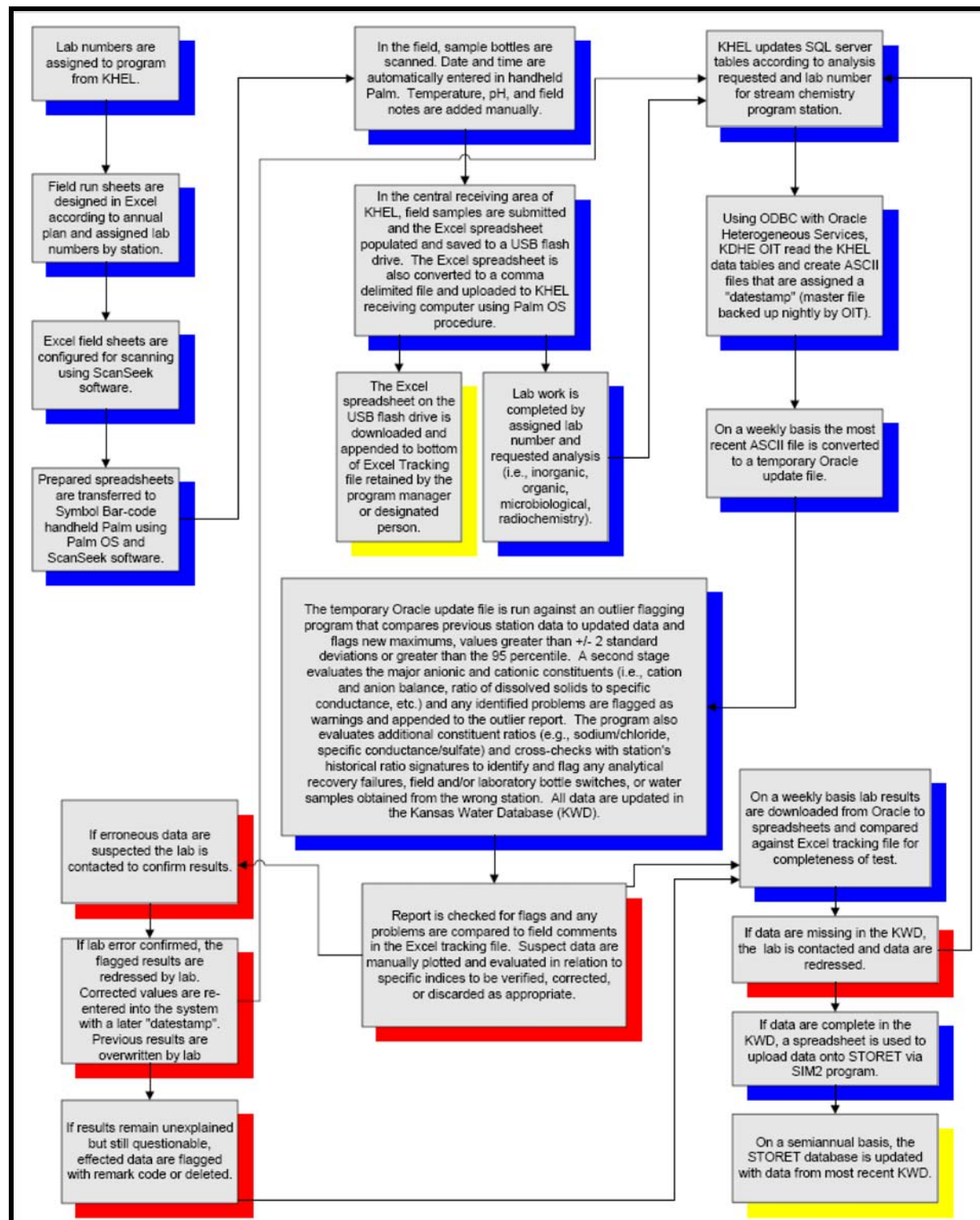
On a weekly basis, the most recent ASCII file is converted to a temporary Oracle update file. This file is run against an in-house outlier flagging program that generates an outlier/warning report on a station-by-station and parameter-by-parameter basis by automatically comparing new data to the historical database and flagging any new value that (a) exceeds the historical maximum value for the site in question, (b) extends more than 2.0 standard deviations beyond the historical mean concentration or (c) exceeds the established 95th percentile concentration. A second stage data warning system performs 12 different QA/QC checks to accept, qualify or reject data for inclusion in the Oracle KWB and, ultimately, the modern STORET database system. This mathematically intensive application incorporates algorithms for checking cation and anion balances, dissolved solids/specific conductance ratios, and elemental concentrations versus constituent concentrations (e.g., total phosphorus versus ortho-phosphate - P) (APHA 1998). Values that do not meet the data acceptance criteria set forth in Table 4.9.1-1 are flagged as warnings and appended to the outlier report. Additional constituent ratio calculations are also performed (e.g., sodium/chloride ratios, specific conductance/sulfate ratios). These checks reveal distinct physicochemical signatures for each water quality monitoring station and facilitate the identification of field and analytical mistakes resulting from the application of erroneous dilution factors, misinterpretation of laboratory analytical instrumentation, switching of field and/or laboratory sample bottles, collection of water from the wrong stream locations, and other factors. The report is manually checked for flags, and any documented problems are initially compared to field comments (relevant QC documentation) in the program’s Excel spreadsheet sample collection tracking file.

#### 4.9.2 Data Acceptance Criteria

Once flagged, suspect data are evaluated by the program manager (usually in consultation with the section chief and data management staff) and verified, corrected or discarded, as appropriate. In addition, on a weekly basis, newly released data are electronically plotted and visually evaluated in relation to QC indices by the program manager and data management staff. If warranted, the lab is contacted to confirm the reported analytical results. If a laboratory error is discovered, the erroneous values in the KHEL database are replaced with the correct values and the amended data are released with a later “datestamp.” If results remain unexplained, the stream chemistry program manager may consult with other program personnel and/or KHEL analytical staff and consider any relevant (field or laboratory) QC documentation. Information derived from field QC samples (duplicates, spikes, blanks, etc.) are subjected to particularly thorough review. Data that are deemed

TABLE 4.9.1-1

DATA MANAGEMENT FLOW CHART



inaccurate or grossly unrepresentative are purged from the electronic database by the program manager, generally following consultation with the section chief and data management staff (section 4.9.8, below).

On a monthly basis, laboratory results are downloaded from Oracle to computer spreadsheets and electronically compared to the Excel tracking file to assess completeness. If data are missing in the KWD, KHEL is directed to re-drop the missing data. If data are complete in the KWD, the same spreadsheet is used to enter data on STORET via the SIM2 program. On a semiannual basis, the STORET database is overwritten (KDHE component) using the KWD. Redundant forms of data storage and backup (e.g., STORET, KWD, KHEL tape files ) help to ensure the long-term integrity and availability of the program data.

TABLE 4.9.2-1

DATA ACCEPTANCE CRITERIA

Quality Control Analysis	Acceptable Ratio or Result
Calculated Total Dissolved Solids (TDS)/ Lab TDS	0.98 - 1.02
Major Cation/Major Anion	0.90 - 1.10
Calculated TDS/Specific Conductance	0.50 - 0.85
Lab TDS/Calculated Specific Conductance	0.50 - 0.85
Measured DO/Percent DO Saturation	< 5 mg/L; > 130%
Ortho- $\text{PO}_4^{3-}$ - P versus Total P	Total P $\geq$ ortho- $\text{PO}_4^{3-}$ - P
Ammonia - N versus Kjeldahl N	Kjeldahl N $\geq$ Ammonia - N
Total Suspended Solids/Turbidity	Compare to historical station specific ratio ranges
Sodium/Chloride	Compare to historical station specific ratio ranges
Specific Conductance/Sulfate	Compare to historical station specific ratio ranges
Major Cation/Specific Conductance	Compare to historical station specific ratio ranges
Major Anion/Specific Conductance	Compare to historical station specific ratio ranges

#### 4.9.3 Reporting Limits

The departmental laboratories frequently encounter parameter values or concentrations that are greater than or less than levels that can be reliably measured (i.e., measured within specified limits of precision and accuracy). Accordingly, the laboratories report both lower and/or upper quantitation limits depending on the analyte. These quantitation limits are used as method reporting limits (MRLs). If an analyte is not present in an amount that can be reliably quantified, its concentration is accorded a specific code and denoted as “censored” data.

#### 4.9.4 Storing Censored Data

All censored stream chemistry parameter values are stored in the Kansas Water Database with remark codes. A “K” character or a less-than sign (<) under the analytical constituent name column (coded sign field) indicates an analyte either is not detected or detected at a concentration that is less than the method reporting limit (MRL). In addition, an “L” character or a greater-than sign (>) under the coded sign field indicates an analyte is at a concentration that is greater than the MRL. If the parameter concentration is reportable (i.e., greater than or equal to the MRL) the analytical result is recorded in the result field under the analytical constituent name column and the coded sign field is nulled to indicate the parameter is present at a quantifiable concentration.

#### 4.9.5 Plotting and Data Transformations

Many forms of environmental data do not conform to a normal distribution and may necessitate the use of nonparametric statistical methods. Alternatively, the data may be transformed statistically to induce a normal or log normal distribution or some other preferred data distribution. In general, data are first graphed to reveal the general shape of the distribution and to help identify the most appropriate transformation procedure. Commercially available computer programs may be applied in more detailed assessments of data distribution. Minitab statistical software maintained on BEFS desk top computers offers several algorithms for characterizing departure from normality (e.g., Ryan-Joiner and Kolmogorov-Smirnov tests).

#### 4.9.6 Statistical Methods for Handling Censored versus Uncensored Data

Historically, statistical options for dealing with censored data have been rather limited. Nonparametric procedures based on rank-order or percentiles tend to be less influenced by these kinds of data and are often favored by staff performing statistical characterizations, comparisons and trend analyses. More recent strategies employed in the stream chemistry monitoring program are summarized in tables 4.9.6-1 and 4.9.6-2. These approaches are based on the recommendations of Helsel (2005).

#### 4.9.7 Statistical Outliers

Water quality data occasionally may include anomalous values or statistical outliers. Obvious outliers (those that are orders of magnitude beyond any reasonable value) often constitute data transcription errors or measurement unit conversion errors. In other instances, outliers may reflect

the gross contamination of samples, analytical errors, or an actual (though rarely occurring) fluctuation in water quality. In the stream chemistry monitoring program, data are automatically questioned by staff if reported sequential duplicate concentrations vary by more than 20 percent or if a value is outside the historical range for the parameter and monitoring site in question. If follow-up consultations with field, laboratory, and data management personnel provide no reasonable explanation for a questionable value, the program manager may flag the value or delete the value from the database (section 4.9.1).

TABLE 4.9.6-1.

STATISTICAL METHODS FOR HANDLING UNCENSORED AND CENSORED DATA

Methods for Uncensored Data Sets	Methods for Censored Data Sets
<b>Computing Summary Statistics</b>	
Descriptive Statistics	Kaplan-Meier, MLE, or ROS estimates
<b>Comparing Two Groups</b>	
t-test	Censored regression with 0/1 group indicators
Wilcoxon rank-sum test	Generalized Wilcoxon test
paired t-test	Censored confidence intervals on differences
(paired) sign or signed-rank test	Paired Prentice-Wilcoxon or Akritas tests
<b>Comparing Three or More Groups</b>	
ANOVA	Censored regression with 0/1 group indicators
Kruskal-Wallis test	Generalized Wilcoxon test
<b>Correlation</b>	
Pearson's r	Likelihood r
Kendall's tau	Kendall's tau-b
<b>Linear Regression</b>	
Regression	Censored regression
Robust Regression	Logistic regression
Theil-Sen median line	Proportional hazards (Cox) regression
	Akritas-Theil-Sen median line

(Source: Helsel 2005)

TABLE 4.9.6-2

ESTIMATION OF SUMMARY STATISTICS FOR CENSORED DATA

<b>Recommended Techniques for Interpretation of Data</b>		
<b>Percent Censored Data:</b>	<b>&lt; 50 observations</b>	<b>&gt; 50 observations</b>
< 50% nondetects	Kaplan-Meier	Kaplan-Meier
50 - 80% nondetects	Robust Maximum-Likelihood Estimation (MLE) or Robust Regression on Order Statistics (ROS)	Maximum-Likelihood Estimation (MLE)
> 80% nondetects	report only % above a meaningful threshold	may report high sample percentiles (90th, 95th)

(Source: Helsel 2005)

#### 4.9.8 Verification of Calculations

Computer-based mathematical, statistical, graphical and geographical programs and models involving environmental data are tested before application by comparison to other computer programs, through hand calculations involving randomly selected data, or through other appropriate means. The reliability of these models and programs is reexamined on at least an annual basis or whenever a problem is reported within a computational system.

#### 4.9.9 Ancillary Data

Ancillary data used in this program may include hydrological, meteorological, or biological data derived from other state and federal agencies. An effort is made to ensure that these agencies have appropriate QA program plans (QAPPs) in place. In some instances, these agencies collect data under contract to KDHE, or under the auspices of an EPA grant, both of which require development and approval of a QAPP prior to data collection (see QMP, Part I, section 2.3). Pollutant loading coefficients and some other values applied in modeling calculations are taken from documents produced by governmental agencies or from literature sources incorporating peer review of articles before publication. Program staff carefully examine the underlying technical assumptions before applying these coefficients and values.

#### 4.10 Quality Assurance Reporting Procedures

End-of-year program evaluations are compiled by the section chief, and a written report is submitted to the bureau QA representative, bureau director, and divisional QA officer by February 15 of the following year. The program manager cooperates in this evaluation and, at the request of the section chief, provides all records gathered during the evaluation period on the precision, accuracy, representativeness and comparability of the monitoring data. Program evaluations submitted by the

section chief indicate when, how, and by whom the evaluation was conducted, the specific aspects of the program subjected to review, a summary of significant findings, and technical recommendations for necessary corrective actions. The section chief discusses the reported findings with the program manager and other program staff.

#### 4.11 Purchased Equipment and Supplies

When newly ordered or recently repaired sampling, analytical or computational equipment is delivered to the program office, the program manager (or designee) compares the item to that requested on the original order, then inspects the equipment to ensure no breakage has occurred in transit and all components function properly. Once this inspection is completed, the manager (or designee) either accepts or rejects the shipment. Office and laboratory supplies receive a comparable level of scrutiny. Reference standards and equipment must be accompanied by a certificate from the vendor or manufacturer verifying the quality of these products.

#### 4.12 Program Deliverables

Program deliverables include electronic databases, illustrative materials, statistical water quality summaries, and detailed written reports used in a variety of agency applications. Staff of the stream chemistry monitoring program play a major role in the development of the Kansas biennial water quality assessment (305(b) report) and the Kansas list of water quality limited surface waters (303(d) list). As resources and circumstances allow, customized data retrievals are prepared by the program manager on behalf of administrative staff, legislative officials, other state and federal agencies, regulated entities, special interest groups, consultants, academicians, students, and members of the general public.

## **Section 5**

### **REVIEW AND REVISION OF PLAN**

To ensure that the stream chemistry monitoring program continues to meet the evolving informational needs of the bureau and the agency, all portions of this QA management plan and its appended SOPs must be comprehensively reviewed by participating staff on at least an annual basis. Revisions to the plan and SOPs require the approval of the program manager, section chief and bureau QA representative prior to implementation. Although review and revision activities normally follow the annual program evaluation in February, these activities may be implemented at any time based on urgency of need or staff workload considerations.

Original approved versions of the QA management plan and SOPs, and all historical versions of these documents, are maintained by the bureau QA representative or his/her designee. The bureau QA representative also maintains an updated electronic version of the plan and SOPs on the KDHE internet server in a "read only" pdf format.

## **APPENDIX A**

### **FIELD EQUIPMENT AND SUPPLY CHECKLIST**

## **FIELD EQUIPMENT AND SUPPLY CHECKLIST**

### **I. VEHICLES**

- A. Primary sampling vehicle (three-quarter ton van with 11.25-foot wheel base, load range D tires, sliding/latching side door, double back door, cargo safety screen, roof-mounted hazard lights)  
  
Alternate rental vehicles and district vehicles (various models, attributes and accessories, depending on availability)
- B. Vehicle registration and proof of insurance
- C. Vehicle log book (Wright Express card, list of Wright Express service stations, copy of tire contract)
- D. Vehicle key and spare key(s)
- E. Mobile cellular telephone, instructions
- F. Fluorescent orange or yellow safety vests with reflective strips, orange or yellow rain coats or ponchos with reflective strips
- G. Fire extinguisher, first aid kit, CPR mouthpieces, latex rubber gloves, sunscreen, paper and cloth towels, hand sanitizing solution in plastic squeeze bottle, safety glasses, portable eyewash station, automated external defibrillator (AED)
- H. Full-size spare tire (fully inflated), tire changing equipment, road reflectors and/or flares
- I. Tool kit, jumper cables, tow rope, windshield ice scrapers, flashlights (fully operable)

### **II. OTHER FIELD EQUIPMENT AND SUPPLIES**

- A. Weighted stainless-steel sampling bucket (1 gal)
- B. Stainless-steel pail (1 gal)
- C. Stainless-steel funnel
- D. Stainless-steel crucible tongs
- E. Concrete-weighted ice breaker

- F. Ropes, static nylon fiber, 75-ft length and 55-ft length with snap swivels on both ends and a 25-ft used when collecting water quality samples in streams known to contain live zebra mussels (*Dreissena polymorpha*)
- G. Ice chests (100-qt capacity) containing bags of crushed ice
- H. Wooden flats for sample container transport
- I. Plastic tub for sample handling and transport
- J. Sample containers with barcode labels (including two or more sets of spare containers) (Note: each barcode label has a two-letter code at the end of the four digit number to insure the correct scanning of bottles (i.e., cube "CM," total organic carbon "TC," trace metal "HM," dissolved oxygen "DO," nutrient "NT," bacteria "BC," pesticide "OC," rad health "RD," and tritium "TT").
- K. Glass beakers (100 ml)
- L. Polyethylene disposable gloves
- M. Glass distilled water (in squeeze bottles and cubitainers)
- N. Clipboard (with maps, field sheets, etc.), pencils, pens, markers and labeling tape
- O. Digital camera, with digital diskette, carrying case, instructions
- P. Symbol SPT 1800 Palm OS handheld computer

### III. FIELD MEASUREMENT APPARATUS

- A. Thales Mobile Mapper Pro global positioning system (GPS) and carrying case
- B. Fisher model #15-0778 stainless-steel dial scale thermometer (-10 to +110 °C)
- C. Cole-Parmer model #5996-70 field pH meter (analog readout with instruction manual, carrying case, combination pH probe, and pH 4, 7 and 10 buffer solutions)
- D. Winkler dissolved oxygen kit (with reagents "1, 2, 3" in 250-ml Nalgene safety squeeze bottles, transported in sealed plastic container with removable lid; see Appendix B)

## **APPENDIX B**

### **STANDARD OPERATING PROCEDURES**

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<u>Procedure</u>	<u>No.<sup>1</sup></u>	<u>Revision Date</u>
Global Positioning System (GPS) Procedures for Determination of Geographical Location of Stream Monitoring Stations (SCMP-001) . . . .	2	02/05/07
Vehicle Safety and Maintenance Procedures (SCMP-002) . . . . .	2	02/05/07
Operational and Maintenance Procedures for Field Analytical Equipment (SCMP-003) . . . . .	2	02/05/07
Procedures for Field Analytical Measurements (SCMP-004) . . . . .	(R)	12/01/00
Procedures for Collecting, Preserving and Transporting Stream Water Samples (SCMP-005) . . . . .	2	02/05/07
Chain-of-Custody Procedures for Stream Water Samples and Field-Prepared Quality Control Samples (SCMP-006) . . . . .	2	02/05/07
Procedures for Field Blank Samples (SCMP-007) . . . . .	0	12/01/00
Procedures for Field Duplicate and Replicate Samples (SCMP-008) . . . .	2	02/05/07
Procedures for Field Spiked Samples (SCMP-009) . . . . .	2	02/05/07
Procedures for Container Blank Samples (SCMP-010) . . . . .	0	02/05/07
Procedures for Creating an Excel Spreadsheet Template and Creating a Specific Network Run File for Download to Palm OS Handheld Computer (SCMP-011) . . . . .	0	02/05/07
Procedures for Connecting and Downloading Electronic Field Sheet to Palm OS Handheld Computer (SCMP-012) . . . . .	0	02/05/07
Procedures for Configuring Data Exchange with ScanSeek Software (SCMP-013) . . . . .	0	02/05/07
Procedures for Entering Field Data on Palm OS Handheld Computer (SCMP-014) . . . . .	0	02/05/07
Procedures for Synchronizing Data on Palm OS Handheld Computer using Laptop or Personal Computer (SCMP-015) . . . . .	0	02/05/07
Procedures for Transfer of Electronic Data and Uploading to Laboratory Data Collection System (SCMP-016) . . . . .	0	02/05/07

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<sup>1</sup>The designation “(R)” indicates a procedure or set of procedures has been rescinded or incorporated into another SOP.

**GLOBAL POSITIONING SYSTEM (GPS) PROCEDURES FOR  
DETERMINATION OF GEOGRAPHICAL LOCATION OF STREAM  
CHEMISTRY MONITORING STATIONS (SCMP-001)**

**I. INTRODUCTION**

**A. Purpose**

Accurate documentation of geographical position (longitude and latitude) reduces the risk of obtaining samples from the wrong monitoring site and facilitates the analysis of monitoring data through geographical information system (GIS) techniques. The location of all monitoring sites included in the KDHE stream chemistry monitoring network must be precisely documented using GPS procedures.

**B. Minimum Staff Qualifications**

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the use of GPS equipment and possess a basic understanding of the underlying technology.

**C. Equipment/Accessories**

1. Carry bag or case
2. Thales Mobile Mapper Pro GPS receiver
3. External antenna
4. Power/data cable
5. PC cable with cigarette lighter adapter
6. Serial-to-Universal Serial Buses (USB) cable
7. Battery charger

**II. PROCEDURES**

**A. Equipment Set-Up and Operation**

Procedures described in the Thales Mobile Mapper Pro standard operating procedure, which may be viewed on the KDHE intranet server (GeoSpatial Services), are adopted by reference.

**B. Equipment Take-Down and Post Processing Data**

Procedures described in the Thales Mobile Mapper Pro standard operating procedure, which may be viewed on the KDHE intranet server (GeoSpatial Services), are adopted by reference.

## **VEHICLE SAFETY AND MAINTENANCE PROCEDURES (SCMP-002)**

### **I. INTRODUCTION**

#### **A. Purpose**

The following text outlines vehicle safety and maintenance procedures used during the collection and transport of stream chemistry samples. Safety procedures are established to prevent or minimize property damage, personal injuries, and/or loss of life. Maintenance procedures are established to prevent or minimize vehicle breakdowns and to extend the usable life of the vehicle. Accidents and mechanical failures are costly and result in loss of productivity.

#### **B. Minimum Staff Qualifications**

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should possess a valid Kansas driver's license and current certifications in standard first aid, cardiopulmonary resuscitation (CPR), and use of automated external defibrillators (AEDs). Although not required, these employees are strongly encouraged to participate in defensive driving courses offered by some law enforcement agencies and other qualified organizations.

#### **C. Equipment/Accessories**

Van, three-quarter ton, with 11.25-foot wheel base, load range D tires, sliding/latching side door, double back door, cargo safety screen, mounted emergency flashing lights, portable emergency road reflectors or road flares, fire extinguisher, spare tire, tire changing equipment, jumper cables, tow rope, tool kit, first aid kit, disposable latex gloves, disposable CPR mouthpieces, safety glasses, emergency eye wash station, flashlight, windshield ice scraper, cellular phone with magnetic mountable antenna, AM/FM radio, and all other equipment indicated in Appendix A. (Note: any other vehicle driven by program staff or district office staff while engaged in stream monitoring operations should include comparable safety equipment and accessories, with the exception of the cargo screen, sliding and double doors, and roof-mounted hazard lights which are installed only on the primary sampling van.)

### **II. PROCEDURES**

#### **A. Vehicle Safety Procedures**

1. The following conditions and safety precautions must be met and observed while operating motor vehicles in association with stream monitoring operations:

- a. Vehicle operators must possess a valid Kansas driver's license.
  - b. Drivers shall abide by all applicable regulations for operation of motor vehicles.
  - c. SEAT BELTS MUST BE WORN AT ALL TIMES WHILE OPERATING OR RIDING IN MOTOR VEHICLES.
  - d. Drivers shall observe posted speed limits. Upon encountering slippery road conditions, high winds, reduced visibility, road construction, heavy traffic, slower traffic (e.g., farm or construction vehicles, bicycles, pedestrians, saddle horses, horse drawn carriages, trucks with oversized loads, military convoys, etc.) or other conditions warranting greater caution, drivers shall slow to a reasonable and prudent speed.
  - e. Driver's shall avoid tailgating or "drafting" and observe proper driving intervals behind the vehicle ahead.
  - f. Drivers shall pass other vehicles only when and where the safety and legality of passing is not in doubt.
  - g. Electrical turn signals or, in emergencies, proper hand signals shall be used when operating vehicles.
  - h. Drivers shall become familiar with vehicle manufacturer's operating instructions and drive vehicle accordingly.
  - i. Drivers shall not use cell phone while driving. When receiving incoming cell calls, drivers are to delay answering (or allow to go to voice message) until the vehicle can safely be parked on the shoulder of the road (or if no shoulder exists the nearest safe parking location).
2. Vehicles shall be checked for any apparent safety problems before and after each sampling trip. Vehicles with potentially serious operational defects shall not be used for sampling events. Concerns about vehicle safety shall be directed immediately to the program manager or higher level supervisor.
  3. Vehicles shall not be operated when the driver has been on the job for more than ten hours or when the driver is exhausted, ill, or taking medications or drugs that may cause drowsiness or impair sensory functions, reflexes or reasoning. Smoking in vehicle is strictly prohibited.
  4. Cargo transported in sampling vehicles shall not be stacked higher than the driver and passenger seat backs, even in vehicles equipped with cargo safety screens.

5. Except for the cargo safety screen and roof-mounted hazard lights, which are installed only on the primary sampling van, safety equipment indicated in paragraph I.C, above, shall be maintained in all agency vehicles used for stream chemistry monitoring operations.
6. Sampling vehicles shall not be parked in any location or in any manner that may create a traffic hazard or impede the flow of traffic. Parking or stopping of sampling vehicles on bridges is strictly prohibited.
7. When obtaining samples or performing related reconnaissance activities, park on the shoulder of the road within walking distance of the bridge (or as far to the side of the road as practicable if no shoulder exists). In urban and other heavily congested areas, a nearby parking lot generally offers the safest parking alternative.
8. Upon approaching a stream that is scheduled for sampling or reconnaissance activities, engage the roof-mounted hazard lights on the sampling van (or the emergency flashers on alternate vehicles and district vehicles). After parking near the bridge, check to make sure the hazard lights (or flashers) are engaged prior to leaving the parked vehicle. Look for traffic in the side-view mirror, then look for traffic over the shoulder, before carefully opening the door and exiting the vehicle.

B. Vehicle Maintenance Procedures

1. The sampling vehicle shall be scheduled for normal service maintenance every 5,000 miles. Routine maintenance is performed by a designated maintenance provider and typically includes changing of oil and oil filter, lubrication of chassis and suspension, checking of fluid levels/antifreeze strength, rotation of tires, and inspection of belts, hoses, tires, shocks and/or struts, brakes, air conditioner, heater, dash and exterior lights, windshield wipers, and exhaust system. Other repairs are performed as needed.
2. Other routine maintenance, such as tune-ups, air and fuel filter replacement, wheel bearing inspection and grease repacking, "wheels off" brakes inspection, etc. shall be performed according to the vehicle manufacturer's recommendations or when warranted. This information may be obtained either in the vehicle owner's manual or by contacting the designated maintenance provider.
3. For emergency repairs, unscheduled maintenance, or towing of vehicles, field staff shall attempt to contact the program manager, section chief or bureau director for guidance. In the event field staff are unable to contact the appropriate parties and circumstances dictate an immediate resolution, staff may elect to cover expenses out of pocket with the expectation of being

reimbursed at a later time by the agency. If immediate assistance is needed after normal business hours, field staff also can contact the KDHE Emergency Spill Response Reporting Number (785 296-1679), active 24 hours a day, seven days a week. Operators taking such calls can help track down higher-level departmental personnel or otherwise contact the requested parties on behalf of field staff.

4. The purchase of tires is covered under State contract. A copy of the current contract shall be attached to the vehicle log clipboard.
5. An adequate supply of fuel shall be maintained in the gas tank at all times. Fuel can only be purchased with the Wright Express card at Wright Express locations. A current Wright Express directory shall be attached to the vehicle clipboard. When purchasing gasoline, confirm that the vendor is an approved Wright Express vendor prior to pumping fuel. During the refueling process, clean the windshield if necessary. Check the engine oil level and visually inspect the tires at least once every two weeks, or every 500 miles, whichever comes first.

Steps required to purchase fuel:

- (a) Use the assigned card that displays the vehicle identifier on the lower left hand side. Enter the six-digit driver identification number and current odometer reading on the electronic keypad, either at the pump or inside the station.
  - (b) After fueling, obtain a printed electronic receipt and document transaction on vehicle travel log.
6. The vehicle log shall be updated each time the vehicle is utilized by entering the appropriate date, operator's name, mileage, and destination. All vehicle purchases and/or repair costs shall also be reported in the vehicle log. The vehicle logs and accompanying receipts shall be turned over to assigned clerical staff and forwarded to the KDHE Business Office on a monthly basis.

## OPERATIONAL AND MAINTENANCE PROCEDURES FOR FIELD ANALYTICAL EQUIPMENT (SCMP-003)

### I. INTRODUCTION

#### A. Purpose

The following text establishes standard procedures for the proper care, calibration, and maintenance of pH meters and thermometers.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the chemical and physical properties of surface water and have a basic technical understanding of the associated measurement apparatus.

#### C. pH Meter Specifications

Manufacturer: Cole-Parmer  
Instrument type: Field Analog pH Meter  
Model number: 5996-70  
Range: 0 to 14 pH Units  
Resolution: 0.1 pH Units

#### D. Thermometer Specifications

Manufacturer: Fisher  
Instrument type: Dial scale thermometer  
Model number: 15-0778  
Range: -10 to 110 degrees Celsius (°C)  
Resolution: 1°C

### II. PROCEDURES

#### A. pH Meter

The field pH instrument features battery operation, two point standardization, and manual temperature compensation. It is used in conjunction with a combination glass/calomel reference pH electrode. When properly calibrated, standardized, and compensated with respect to temperature, it provides an accurate analog readout of sample pH, defined as the negative logarithm of the hydrogen ion activity in moles per liter. In most surface water samples and other dilute solutions, hydrogen ion activity is essentially identical to hydrogen ion concentration.

1. pH Meter Calibration and Standardization

- a. Meter is factory calibrated but may require zeroing of readout needle. Check needle position with meter turned off. If needle does not read zero, then use mechanical zero screw to adjust needle to zero.
- b. Connect pH electrode to instrument, remove electrode cap and liberally rinse electrode tip and barrel with demineralized water from squeeze bottle.
- c. Immerse electrode in pH 7 buffer solution and turn meter on. Stir electrode gently while adjusting **SET** control for a reading of 7.0. Allow reading to stabilize before proceeding to next step.
- d. Rinse the electrode thoroughly in demineralized water, and gently shake off excess water.
- e. Immerse electrode in either pH 4 or pH 10 buffer solution such that standardization brackets the expected pH range of sample.
- f. Allow a few seconds for the reading to stabilize, then adjust **SLOPE** control for a pH reading of 4.0 or 10.0 (depending on buffer used).
- g. Rinse the electrode in demineralized water, and shake off excess water.
- h. Meter is now calibrated, standardized, and ready to use.

**NOTE:** Above steps should be repeated at beginning of each day of sampling run. Measure pH 7.0 buffer at intervals during day as additional safeguard. If zeroing and standardization are necessary, also repeat steps d-h, above.

2. pH Meter Operation

- a. After above procedures are completed, immerse electrode in sample. Set temperature knob to sample temperature (measured with Fisher model #15-0778 stainless-steel dial scale thermometer; see below). Gently stir electrode, and allow time for pH reading to stabilize.
- b. After stabilization, read the analog display for sample pH. Record indicated pH value on handheld computer and field data sheet.
- c. Using plastic squeeze bottle filled with demineralized water, rinse electrode tip and barrel thoroughly. Immerse electrode bulb and

lower portion of barrel in 100-ml beaker of demineralized water between sample measurements (e.g., during travel between sampling stations).

**NOTE:** If the accuracy of a measured pH value is in doubt, place the electrode in pH 7.0 buffer to check instrument operation. If standardization is necessary, repeat step 1(a-h), above. After instrument is recalibrated and deemed to be operating properly, collect an additional fresh sample using the stainless-steel pail and repeat step 2 (a-c), above, to confirm or correct the previous pH reading.

### 3. pH Meter Inspection and Maintenance

- a. Proper calibration of instrument must be confirmed prior to each field trip. If meter is malfunctioning, a backup meter must be used pending repair or replacement of original meter.
- b. Routine maintenance includes periodic electrode and battery replacement. At a minimum, batteries and electrodes must be replaced annually. All maintenance checks and electrode/battery replacements must be noted on instrument log chart located on the inside of lid of meter.
- c. If electrode becomes dirty or if a crust develops, rinse thoroughly with demineralized water or stir electrode in water and detergent solution. **DO NOT** abrade electrode by wiping or cleaning with cloths or paper towels. For protein layers, wash electrode tip with pepsin or 0.1N HCL; for inorganic deposits, wash with EDTA or acids; and for grease or similar films, wash with acetone, methanol or diethyl ether in an appropriately ventilated area well removed from any open flame.
- d. Record all operational problems, routine maintenance actions, and instrument repairs in instrument log chart located on the inside of lid of meter.

### B. Thermometer

The Fisher model #15-0778 stainless-steel dial scale thermometer is an easy to use, portable, manual, direct read instrument. It measures temperature in degrees Celsius within the range -10 to 110 degrees.

1. Thermometer calibration is accomplished by comparing instrument to an NIST-traceable reference thermometer on a yearly basis. If adjustment is

required, carefully turn adjusting nut located on back of dial until correction is completed.

2. When measuring temperature of sample, immerse at least a couple of inches of thermometer probe into sample. Avoid touching probe just prior to and during measurement. Read temperature to nearest one degree by observing indicator on dial. Do not use thermometer to measure substances colder than -10°C or hotter than 110°C.
3. Procedures for thermometer maintenance include a thorough inspection at each new calendar year to ensure instrument is properly calibrated and operating within manufacturer's specifications. If instrument is malfunctioning and/or cannot be calibrated, it must be replaced. If probe becomes dirty or if a crust develops, rinse it thoroughly with demineralized water or a mild detergent solution.

## **PROCEDURES FOR FIELD ANALYTICAL MEASUREMENTS (SCMP-004)**

(NOTE: This procedure, first adopted in 1995, has since been incorporated into SCMP-003. The designation "SCMP-004" has been reserved to avoid the need for renumbering other original SOPs).

## **PROCEDURES FOR COLLECTING, PRESERVING AND TRANSPORTING STREAM WATER SAMPLES (SCMP-005)**

### **I. INTRODUCTION**

#### **A. Purpose**

The following text outlines the proper procedures for the collection, preservation and transport of stream water samples.

#### **B. Minimum Staff Qualifications**

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

#### **C. Field Equipment and Supply Checklist**

See Appendix A.

### **II. PROCEDURES**

#### **A. Safety Requirements and Protocols**

1. All program personnel must read SCMP-002, Vehicle Safety and Maintenance Procedures, before engaging in stream sampling or reconnaissance operations. Procedures and requirements indicated in SCMP-002 must be strictly observed by program personnel.
2. Personnel collecting a sample or performing reconnaissance shall be alert to traffic conditions and exercise caution when walking between sampling vehicle and bridge and when working from bridge. Fluorescent orange or yellow safety vests (or jackets) with reflective strips, or orange or yellow rain coats (or ponchos), shall be worn by all sampling personnel upon exiting sampling vehicle.
3. Sample collectors must apply caution when leaning over bridge railings to lower or retrieve sampling buckets/pails or other equipment. Added caution must be applied when sampling from slippery or icy bridge surfaces.
4. Sampling and reconnaissance operations shall not be attempted if rising water, flooding, inclement weather, bridge or road damage or repairs, or other conditions preclude performance of duties in a safe manner.

5. If thick ice formation, shallow water or other conditions preclude collection of samples from bridge, sampling personnel may attempt to access stream from bank, within road public right-of-way, **provided this can be done without undue risk of personal injury or harm**. Staff shall not walk or drive on frozen streams during sampling or reconnaissance operations.
6. Suitable hand and eye protection are encouraged to be used when preserving samples with acids or other chemical reagents or when handling samples that are obviously contaminated with sewage effluent, livestock waste, or other potentially hazardous or infective materials. Staff shall avoid handling containers with acids or other reagents when sampling vehicle is in motion.
7. Field equipment and supplies, including ice chests, sample containers and containers bearing acids or other chemical reagents, shall be safely stored and secured during transport. Plastic bottles containing acids or other chemical reagents shall be capped and placed in covered plastic storage container when not in use.

B. Collection and Preservation of Stream Water Samples

1. At each monitoring site, stream water samples are obtained from bridge using a rope and weighted stainless-steel bucket or stainless-steel pail. Each sample is collected from downstream side of bridge and from apparent thalweg (deepest appearing point in stream channel cross-section; see glossary), unless woody debris or other obstructions or safety conditions dictate otherwise. The thalweg generally is associated with main flow or main braid of stream.
2. The weighted stainless-steel bucket normally is used to obtain the following sample fractions: physicochemical (total suspended solids, major anions, specific conductance, total dissolved solids), total organic carbon, trace metal (various trace metals and metalloids), dissolved oxygen, nutrients (Kjeldahl nitrogen, total ammonia, total phosphorus), *E. coli* bacteria, pH and temperature, and the tritium samples. The stainless-steel pail is used for pesticide samples (selected pesticides, pesticide degradation products, PCBs), radiological samples and, if necessary, volatile organic compound (VOC) samples.
3. If stream is too shallow for using weighted stainless-steel bucket, then stainless-steel pail is used for all samples. If sample collector cannot retrieve a representative sample from bridge, using either bucket or pail, he/she may sample stream from stream bank subject to restrictions of procedures II.A.5, above. The precise location of sampling point, and the sampling procedures actually used by employee, are recorded on the handheld computer and the field data recording sheet (Appendix C). The back of this sheet may be used

to sketch location of sampling point in relation to bridge and to record other important details.

4. Prior to obtaining water samples from a given stream monitoring station, use handheld computer to scan each bottle by pressing yellow button while directing scanner beam onto bottle barcode. Scanning of barcode will automatically update focus field to the scanned value on handheld computer. Scan bottles in the following order: physicochemical cubitainer, total organic carbon, trace metal, dissolved oxygen, nutrient, bacteria, pesticide, rad health, and tritium bottles. A “NO” appearing on line next to pesticide, rad health and tritium data fields indicates that no bottle is to be scanned, nor any such sample collected. (Note: each barcode label has a two-letter code at the end of the four digit number to insure the correct scanning of bottles (i.e., cubitainer “CM,” total organic carbon “TC,” trace metal “HM,” dissolved oxygen “DO,” nutrient “NT,” bacteria “BC,” pesticide “OC,” rad health “RD,” and tritium “TT”). After scanning last bottle for station, scroll upwards to display Date/Time Field line. All sample containers must have a barcode label and their corresponding identification number recorded on handheld computer and field data recording sheet (Appendix C). All handwritten recorded entries must be neat and legible to avoid confusion of samples and to provide a backup for the electronic form during laboratory submission and analysis.
5. As a backup for identification, using an indelible marker, record the station number on all containers (except the dissolved oxygen, bacteriological, and radiological bottles that are intended to be reused after appropriate lab cleaning). Load scanned sample containers in plastic tub in the event of sample spillage during filling. Conduct this work in sampling vehicle through open sliding/latching side door.
6. Walk to the sampling point on bridge, carrying coil of rope, weighted stainless-steel sampling bucket and stainless-steel sampling pail. Connect rope to bucket by attaching snap swivel at end of rope to nut on bucket (do not use bucket handle for lowering/retrieving bucket). Use rope to slowly lower sampling bucket over bridge railing and beneath surface of stream. Allow bucket to fill completely with stream water. Retrieve sampling bucket and detach rope. Reattach rope to handle of sampling pail and slowly lower pail over bridge railing and beneath surface of stream. Retrieve pail filled with stream water, and disengage rope. Carry bucket, pail and coiled rope back to sampling vehicle. (Note: If a radiological sample is being collected, a one-gallon radiological container is carried to sampling point on bridge and filled from pail before obtaining pesticide sample. The radiological sample is transferred to sampling vehicle with other samples.)
7. Upon return to vehicle, record time of sample collection on handheld

computer and field data recording sheet. Pour pesticide sample into a one-gallon dark glass jug using stainless-steel funnel, and replace and securely tighten Teflon-lined cap on jug. Hold weighted stainless-steel sampling bucket by handle and fill physicochemical, total organic carbon, trace metal, dissolved oxygen, nutrient, and bacterial sample containers, and pH/temperature beaker by carefully pouring water through bucket spout. (Note: If a tritium sample is being collected, fill appropriate 100-ml glass bottle). The dissolved oxygen aliquot should be poured slowly and carefully to minimize aeration of sample. Between poured fractions, gently swirl sample bucket to facilitate mixing of sample. Replace caps on containers and tighten securely. Gently shake total organic carbon, trace metal, and nutrient container to mix sample water and acid preservative. Replace cap on bacterial sample container; tighten securely but avoid touching neck and interior of container and inside of cap. Measure pH and temperature of sample (SCMP-003) and record values on handheld computer and field recording sheet. Preserve dissolved oxygen sample according to Winkler method (see below). Pack pesticide jug, physicochemical cubitainer, total organic carbon bottle, nutrient bottle and bacteriological bottle in chipped ice inside ice chest pending delivery to KDHE laboratory. Store trace metal container and dissolved oxygen bottle in wooden storage flat, and position flat in a deeply shaded location (e.g., under dark towel, cardboard box, or inverted storage flat) pending delivery to KDHE laboratory. Detailed procedures for handling and preserving specific sample fractions are presented below.

(NOTE: When collecting water quality samples in streams known to contain live zebra mussels (*Dreissena polymorpha*), a dedicated rope for these sites is used and the weighted stainless-steel sample bucket and stainless-steel pail are subsequently double rinsed with demineralized water before moving to sites outside the known range of this invasive species.

#### C. Detailed Sample Preservation and Handling Procedures

##### 1. Pesticide Sample

- a. Fill pesticide jug by pouring water directly from stainless-steel pail through stainless-steel funnel. Replace and securely tighten Teflon-lined plastic cap. (Note: Plastic containers or funnels should not be used for collecting/transferring pesticide samples, as organic compounds may leach from plastic and interfere with laboratory analyses.)
- b. Pack sealed pesticide jug in chipped ice in ice chest pending transfer to KHEL.

2. Physicochemical Sample

- a. Fill cubitainer by pouring directly from weighted stainless-steel sampling bucket.
- b. Replace and securely tighten bottle cap. Place cubitainer sample in ice chest and pack in chipped ice pending transfer to KHEL.

3. Total Organic Carbon Sample

- a. Fill total organic carbon bottle by pouring directly from weighted stainless-steel sampling bucket. Avoid overfilling, as bottle has been pre-acidified with phosphoric acid solution.
- b. Replace and securely tighten bottle cap. Gently shake bottle for about 10 seconds. Place nutrient sample in ice chest and pack in chipped ice pending transfer to KHEL.

4. Trace metal Sample

- a. Fill trace metal bottle by pouring water directly from weighted stainless-steel sampling bucket. Avoid overfilling, as bottle has been pre-acidified with nitric acid solution. Leave a one-to-two-inch air space to facilitate mixing of sample.
- b. Replace and securely tighten bottle cap. Gently shake bottle for about 10 seconds to thoroughly mix sample with acid preservative. Place sample in wooden flat. Store flat in secure location in vehicle pending transfer to KHEL.

5. Dissolved Oxygen Sample

- a. Fill dissolved oxygen (DO) bottle by pouring water from stainless-steel sampling bucket slowly and carefully to minimize sample aeration. Put on disposable polyethylene gloves and safety glasses (or other appropriate hand and eye protection) if not already in place.
- b. Add 2 milliliters (ml) of manganous sulfate to sample from Winkler DO kit. This reagent is contained in squeeze bottle labeled #1. (When using a squeeze bottle, force reagent into 2-ml dispensing pipette tip by gently squeezing bottle. Dispense reagent by inverting squeeze bottle while placing pipette tip just above surface of sample.)
- c. Add 2 ml of alkaline potassium iodide azide. The squeeze bottle containing this reagent is labeled #2.

- d. After reagents #1 and #2 have been added to DO bottle, close stopper and invert bottle 25 times for thorough mixing of reagents with sample. Set sample aside until floc has settled one-third of way down bottle. Floc will settle more rapidly in warmer samples than in colder samples.
- e. After floc has settled one-third of way down bottle, add 2 ml of concentrated sulfuric acid from squeeze bottle labeled #3.
- f. Replace stopper, rinse outside of bottle with demineralized water, and invert bottle 25 times to break up floc and ensure thorough mixing of sample and reagents. Development of a dark brown color generally indicates a high amount of DO in sample, whereas a light amber or clear color indicates little or no DO. (Actual DO concentrations, in mg/L, are determined later by KHEL.)
- g. Place sample in wooden flat and store in deeply shaded area of van pending transfer to KHEL.

6. Nutrient Sample

- a. Fill nutrient bottle by pouring water directly from stainless-steel sampling bucket. Avoid overfilling, as bottle has been pre-acidified with sulfuric acid solution.
- b. Replace and securely tighten bottle cap. Gently shake bottle for about 10 seconds. Place nutrient sample in ice chest and pack in chipped ice pending transfer to KHEL.

7. Bacteriological Sample

- a. Fill bacteriological bottle by pouring water directly from sampling bucket. Avoid touching interior of bottle (careless handling may contaminate sample with bacteria from collector's hand).
- b. Shake off some of sample, leaving a one-to-two inch air space at top of bottle to allow for ready mixing of sample during laboratory analysis. Replace and securely tighten bottle cap, avoiding any contact with inside of cap or with interior of sample bottle. Pack sample bottle in chipped ice in ice chest pending delivery to KHEL.

6. Radiological Sample

- a. Fill radiological plastic container by pouring water directly from stainless-steel pail through stainless-steel funnel. Replace and

securely tighten container cap. Avoid overfilling, as bottle has been pre-acidified with nitric acid solution.

- b. Fill tritium glass container by pouring water directly from weighted stainless-steel sampling bucket. Replace and securely tighten container cap.
- c. Store both containers in a secure location in vehicle during transport to KDHE radiological laboratory.

7. Volatile Organic Compound (VOC) Sample (special studies only)

- a. Prior to withdrawing VOC sample from stainless steel bucket or pail, record station name or number, collector's initials, and date of collection on label of vial.
- b. Immerse lip of vial slowly and carefully into sample, until vial gradually fills with water. Completely immerse vial in vertical position, and slowly lift from water so that a bead of water rises above opening of vial.
- c. Float Teflon-lined septum (cap liner) on top of meniscus, ensuring that Teflon side (thin white side) is in contact with water.
- d. Replace cap on vial carefully and tightly. Turn vial upside down, tap lightly, and observe for any air bubbles. If bubbles are present, empty vial, flush with sample water, repeat steps b-c, above, and recheck for bubbles.
- e. Pack vial in chipped ice in ice chest pending transport to KHEL.

8. Temperature and pH Measurements

- a. Fill 50-ml beaker with 30-40 ml of sample water by pouring directly from stainless-steel sampling pail. Immediately insert tip of thermometer into sample, wait 10-20 seconds for equilibration, record sample temperature (to the nearest °C) on handheld computer and field data recording sheet, and withdraw thermometer.
- b. After pH meter has been properly calibrated and standardized (SCMP-003), place probe in beaker, compensate for sample temperature, gently stir probe until pH reading stabilizes, and record stable reading on handheld computer and field data reporting sheet.

## **FIELD CHAIN-OF-CUSTODY PROCEDURES FOR STREAM WATER SAMPLES (SCMP-006)**

### **I. INTRODUCTION**

#### **A. Purpose**

Surface water quality data derived from the stream chemistry monitoring program may be used in agency enforcement actions or in other regulatory endeavors. Field staff involved in sample collection must ensure that water quality samples are maintained in a secure and appropriate setting and that the transfer of samples to appropriate laboratory personnel, and any intermediaries, is accurately and permanently documented. The following paragraphs describe procedures used in the stream chemistry monitoring program for relinquishing and receiving water quality samples and for ensuring their security and integrity from the moment of collection to the time of transfer to laboratory personnel.

#### **B. Minimum Staff Qualifications**

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

### **II. PROCEDURES**

- A. All samples submitted to KHEL for analysis must be accompanied by an appropriate electronically generated sample submission form (Appendix C). This includes water quality samples for physicochemical, nutrient, trace metal, bacteriological, pesticides, radiological samples, and any other special samples analyzed by KHEL.
- B. At the bottom of each sample submission form are fields for chain-of-custody. The first field is signed by at least one member (and ideally all members) of the field crew that collected the samples in question. On the date the samples are delivered to KHEL, the crew member(s) must sign/date the first chain-of-custody field using indelible ink. Staff of KHEL will accept the samples and sign/date the second chain-of-custody field, again using indelible ink. This provides a record of custody from the time of collection to the time of arrival at KHEL.
- C. In practice, two original forms are printed by field crew member(s) at KHEL after electronic transfer of data from the handheld computer to the laboratory computer (SOP No. SCMP-016). After the content of the printed forms is checked for completeness and accuracy, signatures are obtained from field crew member(s) and

laboratory receiving staff. One of the original forms is retained by field staff for routing to the program manager or his/her designee. The second is retained by the laboratory employee receiving the samples.

- D. In the event samples pass through an intermediary en route to the laboratory (e.g., samples are transferred from district staff to central staff), district staff sign/date the first chain-of-custody field on the district handwritten field sheet (electronic backup), using indelible ink. Central staff sign/date the second chain-of-custody field, again using indelible ink. A photocopy is retained for district records and the original form is routed to the program manager or his/her designee. The electronic data is transferred in accordance with SOP No. SCMP-016.
- E. Electronic forms and backup forms completed in the field, contain important empirical data and supporting documentation. Loss of these forms, or any accident that impairs their legibility, would result in a significant loss of data and could necessitate a return trip to the stream(s) in question. Hence, it is imperative that care be taken by staff in the handling, filing and eventual archiving of these documents. Similar considerations apply to any photographs or other forms of documentation obtained during the course of field activities.

## PROCEDURES FOR FIELD BLANK SAMPLES (SCMP-007)

### I. INTRODUCTION

#### A. Purpose

Unless closely monitored and controlled, the inadvertent contamination of samples during collection, preservation, transport, storage, processing and/or analysis may lead to erroneous conclusions about the quality of the environment. Field blanks provide one means of assessing and quantifying the overall extent of sample contamination. The following paragraphs set forth procedures for preparing field blanks utilized in the stream chemistry monitoring program.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

#### C. Equipment/Accessories

1. All items listed in Appendix A
2. Plastic jug (1 gal) filled ASTM Type-I quality water
3. Dark glass jug (1 gal) filled with ASTM Type-I quality water

### II. PROCEDURES

#### A. Preparation of Field Blanks for Inorganic and Bacteriological Sample Fractions

1. Prior to sampling run, fill one-gallon plastic container (that has undergone a rigorous decontamination procedure by laboratory personnel) with ASTM Type-I quality water at KDHE inorganic laboratory. Replace and securely tighten cap. Transport container in sampling vehicle to selected stream monitoring location. Upon arrival, and following completion of regular sampling and field measurement activities (SCMP-005), fill stainless-steel self-filling bucket with glass distilled water by pouring directly from one-gallon jug.
2. Place lid on sample bucket and secure with nut. Gently swirl bucket for about 20 seconds to simulate motion during normal stream sampling procedure. Pour into sample containers. Between poured fractions, gently swirl sample bucket to facilitate mixing of sample.

3. Prepare and transport blank physicochemical, nutrient, trace metal and bacteriological sample fractions, and perform pH and temperature measurements, according to procedures for regular steam water samples given in SCMP-005, section II.C.

B. Preparation of Field Blanks for Pesticide Sample Fraction

1. Prior to sampling run, fill one-gallon dark glass jug with demineralized water at KDHE inorganic laboratory. Replace and securely tighten cap. Transport in sampling vehicle to selected stream monitoring location. Upon arrival, and following completion of regular sampling and field measurement activities (SCMP-005), fill stainless-steel pail with demineralized water by pouring directly from one-gallon jug.
2. Gently swirl pail for about 20 seconds to simulate motion during normal stream sampling procedure.
3. Prepare and transport blank pesticide sample fraction according to procedures for regular steam water samples given in SCMP-005, section II.C.

C. Field Blank Laboratory Identification Codes and Related Considerations

1. The blank sample is assigned a laboratory identification code of SC000. Record sample "collection" time, equaling that of previous regular sample plus five minutes, on the handheld computer and field data recording sheet. (This five-minute time separation will be used, along with identification code, to designate sample as a field blank in Kansas Water Database).
2. Along with other data recorded for blank sample on handheld computer and field data recording sheet, indicate name and number of monitoring station sampled prior to preparation of field blank (to provide an indication of contaminant carry-over from sample to sample).

## PROCEDURES FOR FIELD DUPLICATE AND REPLICATE SAMPLES (SCMP-008)

### I. INTRODUCTION

#### A. Purpose

Sequential and concurrent field duplicate (replicate) samples provide a combined measure of natural sample variability and the variability inherent in sampling and analytical efforts. They allow estimates of data precision to be obtained and incorporated into statistical measures of surface water quality. The following text outlines procedures used in the stream chemistry monitoring program for the collection and handling of duplicate (replicate) stream water samples.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

#### C. Equipment/Accessories

See Appendix A.

### II. PROCEDURES

#### A. Preparation of Field Duplicate or Replicate

1. Follow procedures described in SOP No. SCMP-005 for collection and preservation of water samples and performance of preliminary field measurements.
2. Before leaving stream chemistry monitoring station, generate another (duplicate) set of samples/measurements by repeating all above procedures.
3. If additional (replicate) sets of samples/measurements are desired, repeat the above procedures as many times as needed.
4. If concurrent duplicate samples/measurements are desired, repeat the SCMP-005 procedures but fill separate sample containers concurrently using the same sampling device and water from the same sample “pull” from the stream.
5. Record a five-minute time differential between successive sets of samples/measurements. This time interval will designate the samples as duplicate or replicate samples in the Kansas Water Database.

## PROCEDURES FOR FIELD SPIKED SAMPLES (SCMP-009)

### I. INTRODUCTION

#### A. Purpose

The following paragraphs describe those procedures used in the stream chemistry monitoring program for field spiking water samples with known concentrations of selected chemical parameters. Measured levels of these parameters in spiked samples are compared to those in unamended duplicate samples to provide an overall indication of sample degradation and analytical recovery. Field spikes provide one means of quantifying the accuracy of water quality data.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

#### C. Equipment/Accessories

1. All items listed in Appendix A
2. Stainless-steel pail (3 gal)
3. Trace metal/metalloid reference solution
4. Cation reference solution
5. Anion reference solution
6. Nutrient-1 reference solution
7. Nutrient-2 reference solution
8. TOC reference solution
9. Pesticide reference solution
10. Graduated cylinder, 1-liter, glass, with enlarged plastic stopper
11. Graduated cylinder, 2-liter, glass, with enlarged plastic stopper (2 each)
12. Brinkmann Eppendorf pipette, fixed volume, 1000 FL
13. Brinkmann Eppendorf pipette, adjustable volume, 100-1000 FL
14. Brinkmann Eppendorf pipette tips
15. Hamilton Gastight Syringe, 1.0 mL
16. Pasteur pipette, disposable, borosilicate glass, 5-3/4"
17. Plastic jug, one-gallon, filled with ASTM Type-I quality water
18. Dedicated small cooler with ice packs
19. Zip loc storage bag for containment of used reference solutions
20. Hamilton CR-700-50 constant rate syringe, 2-50 FL

## II. PROCEDURES

### A. Overview of Field Spike Procedures

Follow procedures in SOP No. SCMP-005 for collection and preservation of water quality samples, with following modifications.

1. Carry three-gallon (rather than one-gallon) stainless-steel pail to sampling location on bridge. Attach pail to rope by connecting snap swivel at end of rope to bucket handle. Lower pail over bridge railing and beneath surface of stream. Allow pail to fill completely. If stream is too shallow to submerge three-gallon pail in an upright position, use one-gallon pail to fill larger pail, pouring water slowly to minimize aeration of sample.
2. Transport three-gallon pail with sample to field vehicle. Immediately fill sampling containers and graduated cylinders needed for organic sample fraction (see below). Swirl pail gently before each pour to minimize settling of any suspended materials.
3. Repeat step (1), above. Transport three-gallon pail with sample to field vehicle. Immediately fill sampling containers and graduated cylinders needed for inorganic sample fraction (see below). Swirl pail gently before each pour to minimize settling of suspended materials. Measure water temperature and pH as described in (SCMP-004). Sample containers that have no spike additions (DO and bacteriological) are filled and preserved as described in (SCMP-005.II.B-C).
4. The laboratory identification code for all field-spiked fractions is recorded as SC999. Time of collection for all field-spiked fractions is recorded as five minutes after collection of regular sample. The code and five-minute time differential are used to signify a field-spiked sample in the Kansas Water Database .

### B. Specific Field Spike Procedures

1. Pesticide (Organic) Spike
  - a. Rinse a two-liter graduated cylinder with sample water by pouring water from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water and refill two-liter cylinder to 2000-ml mark (read bottom of meniscus formed when sample water wets cylinder wall). Transfer contents into a one-gallon dark glass jug using funnel and repeat process.
  - b. Use funnel and remaining water in sampling pail to completely fill

another one-gallon dark glass jug. Replace cap and tighten securely. This jug contains unamended pesticide sample.

- c. Invert pesticide ampule several times to mix. Open ampule by carefully snapping at score line. Transfer 1.0 mL of contents using the Hamilton Gastight syringe into jug containing 4000 ml of sample water. Replace Teflon-lined plastic cap and tighten securely. Mix contents of jug by inverting several times. This jug contains amended (spiked) pesticide sample.
- d. Rinse two-liter cylinder three times with glass distilled water, discard rinse water, and store cylinder with other supplies for transport. Pack amended and unamended pesticide sample containers in chipped ice and store inside ice chest pending delivery to KHEL. Place used pesticide ampule in zip loc bag and place in cooler pending transport to laboratory for disposal.

## 2. Combined Trace Metal and Cation Spike

- a. Rinse one-liter graduated cylinder by pouring sample water into cylinder from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water. Pour a predetermined volume of sample water into rinsed one-liter cylinder using funnel. (Note: This volume is calculated prior to sampling run by program manager based on targeted spike amendment, which varies from run to run)
- b. Pour remaining sample water from sampling pail directly into trace metal bottle. This bottle contains unamended trace metal sample.
- c. Invert ampule marked “trace metals” several times to mix. Unscrew cap from ampule and transfer predetermined amount of ampule contents (trace metal reference solution) into one-liter cylinder using adjustable Eppendorf pipette.
- d. Invert ampule marked “cations” several times to mix. Unscrew cap from ampule and transfer predetermined amount of ampule contents (cation reference solution) into one-liter cylinder using adjustable Eppendorf pipette.
- e. Cap cylinder with plastic stopper and invert ten times to mix. Transfer contents of cylinder into trace metal sample bottle. This bottle contains amended (spiked) trace metal sample.
- f. Rinse one-liter cylinder three times with glass distilled water, discard rinse water, and store cylinder with other supplies for transport. Gently shake both (amended and unamended) trace metal bottles approximately ten seconds to ensure thorough mixing of sample and

preservative. Place bottles in wooden flat and store in secure area of sampling vehicle pending delivery to KHEL. Place used metal and cation reference solution ampules in zip loc bag and place in cooler pending transport to laboratory for disposal.

3. Nutrient and Anion Spikes

- a. Rinse a two-liter graduated cylinder by pouring sample water into cylinder from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water. Pour a predetermined volume of sample water into cylinder using funnel.
- b. Apportion remaining sample water among physicochemical container (one-quart cubitainer) and nutrient bottle, pouring directly from pail through funnel. Cubitainer and bottle contain unamended physicochemical sample and unamended nutrient sample, respectively.
- c. Invert ampule marked "anions" several times to mix. Unscrew cap from ampule and transfer predetermined amount of contents (anion reference solution) into two-liter cylinder using adjustable Eppendorf pipette.
- d. Invert ampule marked "nutrient-1" several times to mix. Unscrew cap from ampule and transfer predetermined amount of contents (anion reference solution) into two-liter cylinder using adjustable Eppendorf pipette. (Note: This same cylinder is referenced in steps a and c, above.) Cap cylinder with plastic stopper and invert ten times to mix contents.
- e. Apportion contents of cylinder among physicochemical cubitainer and nutrient bottle. Cubitainer and bottle contain amended physicochemical sample and amended nutrient (ammonia-N) sample, respectively.
- f. Repeat step a, above, using a clean two-liter graduated cylinder.
- g. Invert ampule marked "nutrient-2" several times to mix. Unscrew cap from ampule and transfer predetermined volume of contents (Kjeldahl-nitrogen reference solution) into a clean cylinder using adjustable Eppendorf pipette and clean (unused) pipette tip. Cap cylinder with plastic stopper and invert ten times to mix.
- h. Transfer 250 ml from cylinder referenced in step f and g, above, into clean nutrient bottle. Bottle contains amended nutrient (Kjeldahl-N) sample.

- i. **Caution:** If ammonia-nitrogen and Kjeldahl-nitrogen field spikes are prepared on same stream monitoring run, and at same stream monitoring station, then care must be taken to dilute contents of nutrient-1 (ammonia-nitrogen) ampule and nutrient-2 (Kjeldahl-nitrogen) ampule in different graduated cylinders and to transfer resulting solutions into different nutrient bottles.
- j. Replace and securely tighten bottle caps. Gently shake each bottle for about 10 seconds to ensure complete mixing of sample, any added nutrients, and acid preservative.
- k. Rinse both two-liter graduated cylinders three times with glass distilled water, discard rinse water, and store cylinders with other supplies for transport. Pack all physicochemical sample cubitainers and nutrient sample bottles in chipped ice inside ice chest. Store ice chest in secure location in sampling vehicle pending transport to KHEL. Place used anion and nutrient-1 and nutrient-2 reference solution ampules in zip loc bag and place in cooler pending transport to laboratory for disposal.

4. TOC Spikes

- a. Rinse two-liter graduated cylinder by pouring sample water into cylinder from three-gallon stainless-steel pail through stainless-steel funnel. Discard rinse water. Pour a predetermined volume of sample water into one-liter cylinder using funnel.
- b. Pour remaining sample water from sampling pail directly into TOC bottle. This bottle contains unamended TOC sample.
- c. Invert ampule marked "TOC" several times to mix. Unscrew cap from ampule and transfer predetermined amount of contents (total organic carbon reference solution) into one-liter cylinder using adjustable Eppendorf pipette.
- d. Cap cylinder with plastic stopper and invert ten times to mix. Transfer contents of cylinder into TOC sample bottle. This bottle contains amended (spiked) TOC sample.
- e. Rinse one-liter cylinder three times with glass distilled water, discard rinse water, and store cylinder with other supplies for transport. Gently shake both TOC bottles approximately ten seconds to ensure thorough mixing of sample and preservative. Pack all TOC bottles in chipped ice inside ice chest. Store ice chest in secure location in sampling vehicle pending transport to KHEL. Place used TOC reference solution ampules in zip loc bag and place in cooler pending transport to laboratory for disposal.

## PROCEDURES FOR CONTAINER BLANK SAMPLES (SCMP-010)

### I. INTRODUCTION

#### A. Purpose

Sample bottles are routinely taken for granted to be clean and uncontaminated, especially when using new certified sample bottles or reusable bottles that have undergone a rigorous laboratory decontamination procedure. However, unless routinely monitored for contamination, these bottles can reduce the precision and increase the bias of the environmental data collection process. Container blanks provide an indication of the level of contamination associated with the use of new or reused sample bottles. The following paragraphs set forth procedures utilized in the stream chemistry monitoring program for preparing container blanks and assessing the level of container contamination.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. They also should be experienced in the measurement of the physicochemical and microbiological properties of surface water and in the performance of environmental field investigations.

#### C. Equipment/Accessories

1. All items listed in Appendix A
2. Plastic jug (1 gal) filled with ASTM Type-I quality water

### II. PROCEDURES

#### A. Preparation of Container Blanks for Inorganic and Bacteriological Sample Fractions

1. Prior to sampling run, fill one-gallon plastic container with ASTM Type-I quality water at KDHE inorganic laboratory. Replace and securely tighten cap. Prior to leaving laboratory, pour water directly into a random set of sample bottles or transport in sampling vehicle and then pour directly into a random set of sample bottles under field conditions.
2. Prepare and transport container blank physicochemical, total organic carbon, trace metal, dissolved oxygen, nutrient, and bacteriological sample fractions and perform pH and temperature measurements according to procedures for regular stream water samples given in SCMP-005, section II.C.

B. Container Blank Laboratory Identification Codes and Related Considerations

1. The container blank sample is assigned a laboratory identification code of SC001. Record sample “collection” time on the handheld computer and field data recording sheet.
2. Record bottle number of one-gallon plastic container, and date container was filled, in flow comment section on handheld computer and field data recording sheet.

**PROCEDURES FOR CREATING EXCEL SPREADSHEET TEMPLATE AND  
SPECIFIC NETWORK RUN FILE FOR DOWNLOAD TO PALM OS HANDHELD  
COMPUTER (SCMP-011)**

**I. INTRODUCTION**

**A. Purpose**

The following text outlines the steps taken to create a simple Excel field collection data spreadsheet template, assisted by ScanSeek software. This template can be used as an Open Database Connectivity (ODBC) data source for a Palm OS handheld computer. Through the handheld computer, data can be added, deleted, and edited, and then uploaded back into the original database on a desktop computer (see ScanSeek User's Manual).

**B. Minimum Staff Qualifications**

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

**C. Equipment/Accessories**

Palm OS handheld computer with Palm OS software ( version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) flash drive; cradle or serial/charge cable; power supply cord.

**II PROCEDURES**

**A. Creating Excel Spreadsheet as Data Source for Three- Day Stream Chemistry Run**

1. Launch Excel, starting with a clean spreadsheet.
2. In cell F1 on line 1 (with assigned row height 20.25), enter "KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT." In cell I2 on line 2 (with assigned row height of 20.25), enter "DIVISION OF ENVIRONMENT." In cell B3 on line 3 (with assigned row height of 20.25), enter "PROJECT." In cell J3 on line (with assigned row height of 20.25), enter "DATA FORM."
3. Leave line 4 blank with assigned row height of 12.75.
4. In cell B5 on line 5 (with assigned row height of 15.00), enter "STA." In cell C5, enter "LOCATION." In cell D5, enter "LAB ACCESS." In cell E5,

enter "FIELD DATE." In cell F5, enter "CHEM." In cell G5, enter "TOC." In cell H5 enter "HM." In cell I5 enter "DO." In cell J5 enter "NH3." In cell K5, enter "BACT." In cell L5, enter "PEST." In cell M5, enter "RAD." In cell N5, enter "TRIT." In cell O5, enter "TEMP." In cell P5, enter "FIELD pH." In cell Q5, enter "FLOW CONDITION." In cell R5, enter "COLLECTOR."

5.
  - a. Create *named range* using mouse to select cells for number of stations scheduled plus two blank lines for station additions and QA/QC activities. (e.g., B6 through R19).
  - b. Add station numbers below "STA" header and station locations below "LOCATION" header. (Note: the size of the *named range* will fluctuate depending on sampling run and scheduled QA/QC activities.) Insert "NO" below "PEST," "RAD," and "TRIT" headers if such samples will not be collected from station during sampling run. (These parameter groups are monitored on a quarterly basis; i.e., they are not scheduled every sampling run).
  - c. Type "DAY1" in the range box, then press Enter key.
6. Repeat Step 4 starting on next available blank line.
7.
  - a. Repeat Step 5 a.
  - b. Repeat Step 5 b.
  - c. Type "DAY2" in the range box, then press Enter key.
8. Repeat Step 4 starting on next available blank line.
9.
  - a. Repeat Step 5 a.
  - b. Repeat Step 5 b.
  - c. Type "DAY3" in the range box, then press Enter key.
10. For three-day network runs that include a district office first day sampling run (Northwest sampling runs only), create *named range* using mouse to select cells and insert immediately below "DAY1" *named range*.
  - a. Repeat Step 5 a.
  - b. Repeat Step 5 b.
  - c. Type "DDAY1" in the range box, then press Enter Key

11. For three-day network runs that include a district office second day sampling run (Northwest sampling runs only), create *named range* using mouse to select cells and insert immediately below “DAY2” *named range*.
  - a. Repeat Step 5 a.
  - b. Repeat Step 5 b.
  - c. Type “DDAY2” in the range box, then press Enter Key
12. In cell I50, enter “CHAIN OF CUSTODY.” In cell B52 through F52, enter “Received by: (Signature).” In cell F52 through I63, enter “Date/Time.” In cell J52 through P59, enter “Received by:”. In cell J60 through P63, enter “Received for lab by: (Signature).” In cell Q60 through P63, enter “Date/Time.”
13. Select **Tools, ScanSeek Analyzer...** from menu bar. In the “ScanSeek Analyzer” dialog box, select the *named range* “DAY1” from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer’s actions (ScanSeek User’s Manual). Repeat for *named range* “DAY2,” “DAY3,” “DDAY1,” and “DDAY2.” Select **File, Save as** and name file “SC Three-Day Run Template A,” then press Enter Key.
14. Repeat Step 5b for each *named range* “DAY1,” “DAY2,” “DAY3,” “DDAY1,” and “DDAY2.” Select **File, Save as** and name file “SC Three-Day Run Template B” and exit application.

B. Creating Excel Spreadsheet as Data Source for Two-Day Run

1. Open spreadsheet “SC Three-Day Run Template A” and delete *named range* “DAY3” and “DDAY2.”
2. Add appropriate spaces in *named range* “DAY1” and “DAY2” to balance the spreadsheet aesthetically.
3. For two-day network runs that include a district office one day sampling run (Southwest sampling run only), add or subtract spaces in *named range* “DDAY1” as needed.
4. Reapply station numbers below “STA” header and station locations below “LOCATION” header in “DAY1,” “DAY2,” and “DDAY1.” (Note: the size of the *named range* will fluctuate depending on sampling run and scheduled QA/QC activities.) Insert “NO” below “PEST,” “RAD,” and

“TRIT” headers if such samples will not be collected from station during sampling run. (These parameter groups are monitored on a quarterly basis; i.e., they are not scheduled every sampling run).

5. Select **Tools, ScanSeek Analyzer...** from menu bar. In the “ScanSeek Analyzer” dialog box, select the *named range* “DAY1” from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer’s actions (ScanSeek User’s Manual). Repeat for *named range* “DAY2,” and “DDAY1.” Select **File, Save as** and name file “SC Two-Day Run Template A,” then press Enter Key.
6. Repeat Step 4 above for each *named range* “DAY1,” “DAY2,” and “DDAY1.” Select **File, Save as** and name file “SC Two-Day Run Template B” and exit application.

C. Creating Excel Spreadsheet as Data Source for One-Day Run

1. Open spreadsheet “SC Three-Day Run Template A” and delete *named range* “DAY3,” “DAY2,” “DDAY2,” and “DDAY1.”
2. Add appropriate spaces in *named range* “DAY1” to balance the spreadsheet aesthetically.
3. Reapply station numbers below “STA” header and station locations below “LOCATION” header in “DAY1.” (Note: the size of the *named range* will fluctuate depending on sampling run and scheduled QA/QC activities.) Insert “NO” below “PEST,” “RAD,” and “TRIT” headers if such samples will not be collected from station during sampling run. (These parameter groups are monitored on a quarterly basis; i.e., they are not scheduled every sampling run.)
4. Select **Tools, ScanSeek Analyzer...** from menu bar. In the “ScanSeek Analyzer” dialog box, select the *named range* “DAY1” from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer’s actions (ScanSeek User’s Manual). Select **File, Save as** and name file “SC One-Day Run Template A,” then press Enter Key.

5. Repeat Step 3 above for *named range* “DAY1.” Select **File, Save as** and name file “SC One-Day Run Template B” and exit application.

D. Creating Specific Network Run File for Downloading of Data to Palm OS Handheld Computer

1. Launch Excel and open desired “Network Run Template.”
2. Check accuracy of station numbers below “STA” header and station locations below “LOCATION” header. Add QA/QC stations, assign lab accession number (supplied by KHEL) below “LAB ACCESS” header, and enter names of field staff participating in run below “COLLECTOR” header. Ensure “NO” has been inserted below the “PEST”, “RAD”, and “TRIT” headers if these parameters will not be evaluated during run.
3. Select **Tools, ScanSeek Analyzer...** from menu bar. In the “ScanSeek Analyzer” dialog box, select the *named range* “DAY1” from the drop down menu. Click *Analyze* button to continue. If problems are discovered concerning elements in *named range*, *ScanSeek Analyzer* will display one or more confirmation dialog boxes. Click *Yes* button in each dialog box to enable analyzer to fix problems. When *ScanSeek Analyzer* has corrected all problems, a dialog box will be displayed summarizing the analyzer’s actions (ScanSeek User’s Manual). Repeat for *named range* “DAY2,” “DAY3,” “DDAY1,” and “DDAY2” if necessary.
4. Select **File, Save as** and name the file for run to be completed, and attach date to end of file name (e.g., South-Central Run March 2-4, 2005). Press Enter Key, and copy to a USB flash drive.

## PROCEDURES FOR CONNECTING AND DOWNLOADING ELECTRONIC FIELD SHEET TO PALM OS HANDHELD COMPUTER (SCMP - 012)

### I. INTRODUCTION

#### A. Purpose

The following paragraphs present instructions for establishing an Open Database Connectivity (ODBC) data source and downloading electronic field sheet onto the Palm OS handheld computer.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

#### C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) flash drive; cradle or serial/charge cable; power supply cord.

### II. PROCEDURES

#### A. Setting up Open Database Connectivity (ODBC) on Laptop or Personal Computer

1. Insert USB flash drive containing *Data Exchange* Excel Spreadsheet for scheduled (upcoming) stream chemistry run. Double click on ODBC Data Source icon to display “ODBC Data Source Administrator” dialog box.
2. When ODBC Data Source Administrator dialog box appears, select System DSN tab. Double-click on highlighted “Network” under Name column.
3. Click Select Workbook... button. After “Select Workbook” dialog box appears, navigate to **Drive F** (removable flash drive), select desired Excel file (sample run to be completed), click OK button, then click on OK button in “ODBC Microsoft Excel Setup” dialog box.
4. Click OK button in “ODBC Data Source Administrator” dialog box to close box and return to desktop. This step completes link to stream run database file.

5. Double-click on ScanSeek icon to display “ScanSeek Data Exchange” dialog box. All *Data Exchanges* configured for use on handheld computer are listed in “Active/Data Exchange Name” box.
6. In “ScanSeek Data Exchange” dialog box, select desired *Data Exchange* (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.) by checking the box, marking *Data Exchange* as “Active.” (Note: Only active *Data Exchanges* will be downloaded to handheld computer. De-activate a *Data Exchange* by removing check in box.) If *Data Exchange* is not listed or needs to be reconfigured, see SOP No. SCMP-013.
7. Click button in upper right-hand corner of “ScanSeek Data Exchange” dialog box to exit program.

B. Downloading Data from Laptop or Personal Computer to Palm Handheld Computer

1. Turn on Palm OS handheld computer and start ScanSeek application by tapping icon once on menu screen.
2. Delete all existing *Data Exchanges* by tapping “ScanSeek” highlighted at top of screen. Choose “Delete All” option from Program menu. At prompt, tap “Yes” to verify intended deletion of record. Following deletion of record, return to “Choose a Data Exchange” view. Tap House icon in lower left corner of computer to return to main menu screen.
3. Place Palm OS handheld computer into cradle or attach serial/charge cable from laptop or personal computer.
4. Press HotSync button on front of cradle or tap HotSync icon on main menu screen of handheld computer. (Note: HotSync progress window should appear on desktop, and a similar screen should display on handheld computer.) Wait for software to display message indicating process is complete. If transfer of *Data Exchange* does not occur, view detailed information on HotSync process to correct problems or refer to the HotSync chapter in Product Reference Guide.
5. Open ScanSeek application by tapping icon once on menu screen. Review downloaded *Data Exchanges* (e.g., DAY1, DAY2, DDAY1, DDAY2) on handheld computer for completeness and accuracy.
6. Unplug USB flash drive by clicking on the “Safely Remove Hardware” icon located in the System Tray line on desktop. A prompt will appear “Select the device to unplug?” Select “Mass Storage Device-Drive (F:)” and click “Stop” and remove USB flash drive.

## PROCEDURES FOR CONFIGURING DATA EXCHANGE WITH SCANSEEK SOFTWARE (SCMP-013)

### I. INTRODUCTION

#### A. Purpose

The following paragraphs present instructions for configuring a data exchange assisted by ScanSeek software.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

#### C. Equipment/Accessories

Personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software).

### II PROCEDURES

#### A. Configuring Data Exchange using ScanSeek

1. Double-click on ScanSeek icon to display “ScanSeek Data Exchange” dialog box. All *Data Exchanges* configured for use on handheld computer are listed in “Active/Data Exchange Name” box. To reconfigure an existing *Data Exchange*, click on Configure... button. If required *Data Exchange* does not appear, click New... button.
2. In “Add Data Exchange” dialog box, enter name (i.e., DAY1, DAY2, DAY3, DDAY1, DDAY2, SPDAY1, SPDAY2, etc.) for new *Data Exchange*. Click OK button.
3. After naming *Data Exchange*, ScanSeek Data Exchange Wizard will appear. Follow on-screen instructions to complete configuration of new *Data Exchange*. Click Next button to start data exchange process.
4. Wizard will prompt user to choose ODBC data source for storage of data. A drop down menu will list names of properly configured ODBC data sources (Systems DSNs). Scroll down to “Network” and click on Next button.

5. Wizard will prompt user to choose range within data source containing data intended for download. Use drop down menu to specify range to be accessed. Next, choose field that will be used to search for and identify data records. Use drop down menu to specify "LAB ACCESS." Leave Read Only and Lookup Table boxes unchecked. Click Next button.
6. Wizard will prompt user to customize the way ScanSeek collects data and posts changes to data source. Choose "Only allow one record per search field." This option insures that no two records share the same laboratory accession number. Click Next button.
7. Wizard will display summary screen of *Data Exchange* configuration. Verify all information to make sure *Data Exchange* is configured properly. Should any corrections be needed, click on Back button. If everything is correct, click Finish button.
8. ScanSeek will attempt to validate new *Data Exchange* configuration by verifying that all necessary attributes (e.g., ODBC Data Source) have been assigned and all field options are valid. If ScanSeek finds any errors, an error box will be displayed and *Data Exchange* will be marked "Inactive."
9. In "ScanSeek Data Exchange" dialog box, verify that checkbox to the left of newly created or existing *Data Exchange* is selected, marking *Data Exchange* as "Active." (Note: Only active *Data Exchanges* will be downloaded to handheld computer. De-activate a *Data Exchange* by removing check in box.)
10. Click button in upper right-hand corner of "ScanSeek Data Exchange" dialog box to exit program.

## PROCEDURE FOR ENTERING FIELD DATA ON PALM OS HANDHELD COMPUTER (SCMP - 014)

### I. INTRODUCTION

#### A. Purpose

The following paragraphs present instructions for entering field data on the Palm OS handheld computer.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. Personnel should also have some experience in the use of handheld computers.

#### C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); cradle or serial/charge cable; power supply cord.

### II PROCEDURES

#### A. Entering Data in Field on Palm Handheld Computer

1. Turn Palm OS handheld on and start ScanSeek application by tapping icon once on menu screen. To begin working with a configured *Data Exchange*, select its name from screen.
2. The "Seek in " screen (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.) presents a summary view of data in *Data Exchange*. Select desired *Data Exchange* in view by tapping once. Following selection, handheld computer screen view will display lab accession numbers for every record on left hand column and stream chemistry station numbers on right hand column. To view information for a given station in greater detail, simply tap desired record.
3. On bottom of record detail view, tap Edit button. Edit screen will display the following data fields: station number, location, lab accession number, field date, bottles to be scanned, temperature, pH, flow conditions, and collector name. To edit a particular field, tap anywhere along the line containing field data.
4. To begin barcode scanning process, tap on "Chem" line to activate Auto-Scroll barcode scanning feature. Scan each bottle for each set of samples by

pressing yellow button while directing scanner beam onto designated bottle barcode. Scanning a barcode will automatically update scan focus field with newly scanned value. Scan bottles in following order: cubitainer, TOC, trace metal, dissolved oxygen, nutrient, bacteriological, pesticide, radiological, and tritium bottles. A “NO” appearing on line next to pesticide, radiological, and tritium data fields confirms that such samples are not scheduled for collection. (Note: To insure correct scanning of bottles, each barcode label has a two-letter code at end of a four-digit number. These refer to the following containers: cubitainer “CM,” total organic carbon “TC,” trace metal “HM,” dissolved oxygen “DO,” nutrient “NT,” bacteria “BC,” pesticide “OC,” rad health “RD,” and tritium “TT.”) After scanning last bottle of a set at a given station, scroll up to display Date/Time Field line.

5. Complete field sample collection process (see SCMP-005).
6. Tap Date/Time Field line. Date values and time values associated with a single station are edited separately. To change date portion of any field, tap the date line of that field. The Calendar control will appear, allowing entry of a modified date. Select appropriate year and month, then tap on appropriate day of month. Alternatively, tap on Today button to enter current date and time. To change time portion of any field, tap the time line of that field. The Time control will appear, allowing entry of a modified time. Tap OK button.
7. Tap temperature line, then “123” icon located on lower right corner of interactive screen. A virtual keyboard will appear with Numeric keypad display. Use keypad to enter measured field temperature. To close display, tap Done button followed by X button in upper right portion of the box. Repeat same steps for entering field pH reading.
8. Tap flow conditions line. Tap “abc” icon located on lower left corner of interactive screen. The virtual keyboard will appear with Alpha keyboard display. Use Alpha keyboard to enter text. Enter information in text field on prevailing flow and environmental conditions separating each observation by a backslash. Enter information on flow conditions (e.g., high, low, average) first, followed by information on the appearance of the water (e.g., clear, turbid, slight green cast, etc.), and finally other important information up to a limit of 80 characters total. If no samples are collected, record “No sample” followed by reason (e.g., dry, pooled, etc.). If chlorophyll *a* samples are collected, record the percentage of stream bottom covered by periphyton (e.g., < 5% “none,” > 5% but < 33% as “low,” > 33% but < 67% as “moderate,” > 76% as “high”) and then enter flow conditions. Tap Done button to finish, then tap X button in upper right portion of display to close.
9. Tap Done button to return to “Seek in” screen. Handheld computer is now ready to enter information for next monitoring station.

## PROCEDURES FOR SYNCHRONIZING DATA ON PALM OS HANDHELD COMPUTER USING LAPTOP OR PERSONAL COMPUTER (SCMP - 015)

### I. INTRODUCTION

#### A. Purpose

The following paragraphs present instructions for synchronizing data from the Palm OS handheld computer through HotSync Manager Application, for saving this data to a Universal Serial Bus (USB) flash drive on a laptop or personal computer.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

#### C. Equipment/Accessories

Palm OS handheld computer with Palm OS software ( version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) flash drive; cradle or serial/charge cable, cord; power supply.

### II PROCEDURES

#### A. Synchronizing Field Data on Palm Handheld Computer with Spreadsheet on Laptop or Personal Computer

1. Log on to laptop or personal computer by entering user name followed by current password.
2. Insert USB flash drive containing the *Data Exchange* Excel Spreadsheet for the stream chemistry run. Navigate to **Drive F** and open *Data Exchange* Data file in Excel to confirm availability of spreadsheet. Close Excel.
3. Double click the ODBC Data Source icon to display “ODBC Data Source Administrator” dialog box. When ODBC Data Source Administrator dialog box appears, select System DSN tab. Double-click on highlighted “Network” tab.
4. Click Select Workbook... button to activate “Select Workbook” dialog box. Select desired Excel file (from completed sample run) and click OK button.

- Click OK button in “ODBC Microsoft Excel Setup” dialog box.
5. Click OK button in “ODBC Data Source Administrator” dialog box to close box and return to desktop main menu. This step completes the link to database file containing data from sampling run.
6. Double-click on the ScanSeek icon on laptop or personal computer or laboratory computer system to display the “ScanSeek Data Exchange” dialog box. All *Data Exchanges* configured for use on the handheld computer are listed in the “Active/Data Exchange Name” box. Place a check in box for selected *Data Exchange* (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.). If selected *Data Exchange* does not work properly or is not listed, please refer to SCMP-012 procedures II.B. to reconfigure an existing *Data Exchange* or add a new *Data Exchange*.
7. Place Palm handheld computer into cradle or attach serial/charge cable from the laptop or personal computer or laboratory computer.
8. Press HotSync button on front of cradle or tap HotSync icon on main menu screen of handheld computer (Note: HotSync progress window should appear on desktop, and a similar screen should display on handheld computer). Wait for software to display message indicating synchronization is complete. If transfer of *Data Exchange* does not occur, view detailed information on HotSync process to correct problems or refer to the HotSync chapter in Product Reference Guide.
9. Click the “Safely Remove Hardware” icon located in the System Tray line on desktop. A prompt will appear “Select the device to unplug?” Select “Mass Storage Device-Drive (F:)” and click “Stop” and remove USB flash drive.

## PROCEDURES FOR TRANSFER OF ELECTRONIC DATA AND UPLOADING TO LABORATORY DATA COLLECTION SYSTEM (SCMP - 016)

### I. INTRODUCTION

#### A. Purpose

The following paragraphs present instructions for electronically transferring data from district to central office staff, and for uploading network run electronic data to the laboratory computer system at Forbes Field, Topeka, Kansas. Collectively, these procedures constitute the stream chemistry monitoring program's electronic sample submission system.

#### B. Minimum Staff Qualifications

Personnel implementing this SOP should meet the minimum classification requirements for environmental technician II published by the Kansas Department of Administration. Personnel should also have some experience in the use of ODBC data source and Microsoft Excel software.

#### C. Equipment/Accessories

Palm OS handheld computer with Palm OS software (version 3.0 or later); personal computer or laptop running the Microsoft Windows with Excel; RioScan ScanSeek software; HotSync Manager application (installed as part of Palm Desktop software); Universal Serial Bus (USB) flash drive; cradle or serial/charge cable; power supply cord.

### II. PROCEDURES

#### A. Transferring Electronic Data from District to Central Office Staff

1. Open Excel, and navigate to **Drive F** (removable USB flash drive). Open *Data Exchange* file for the stream chemistry run completed.
2. **District office staff:** check populated spreadsheet for transcription errors, spelling errors, missing information, or unusual spaces in front of character information prior to meeting with central office staff to transfer custody of stream chemistry samples. If any modifications, additions, or deletions are necessary, make changes on the handheld computer in accordance with SCMP-0012 and SCMP-0013. Transfer custody of samples and handwritten field sheet (electronic backup) to central office staff and retain copy for district records (see SCMP-006).

**Central office staff:** transfer district data using Microsoft Explorer. Specifically, drag district run file in **Drive F** to folder “A Flash Drive Transfer” in **Drive C** on laptop. Insert central office Master USB flask drive on laptop and drag district network run file located in “A or Flash Drive Transfer” folder (laptop) to **Drive F**. A message will prompt user to overwrite existing file. Click “Yes” button and close. Open Excel, and navigate to **Drive F**. Open updated *Data Exchange* file. Replace existing place holding accession numbers (e.g., 1,2,3, etc.) in *named range* “DDAY1” and “DDAY2”(Northwest District only). Fill in sequential laboratory numbers by selecting the first cell in the “LAB ASSESS” column, and enter the starting value (laboratory number). To increment the series, select the next cell and enter the next number. Select the cells that contain the starting values. Click on next cell and drag the fill handle over the range you want to fill. Fill in increasing order, by dragging down. After completion, check the entire file for accuracy and completeness and save. A message will prompt user to overwrite existing file. Click “Yes” return to desktop. Click the “Safely Remove Hardware” icon located in the System Tray line on desktop. A prompt will appear “Select the device to unplug?” Select “Mass Storage Device-Drive (F:)” and click “Stop” and remove USB flash drive.

B. Synchronizing Field Data on Palm Handheld Computer using Laboratory Computer

1. Log on to laboratory computer system by entering user name “snetwork” followed by current password.
2. Insert USB flash drive containing the *Data Exchange* Excel Spreadsheet for the stream chemistry run. Navigate to **Drive F** and open *Data Exchange* Data file in Excel to confirm availability of spreadsheet. Close Excel.
3. Double click the ODBC Data Source icon to display “ODBC Data Source Administrator” dialog box. When ODBC Data Source Administrator dialog box appears, select System DSN tab. Double-click on highlighted “Network” tab.
4. Click Select Workbook... button to activate “Select Workbook” dialog box. Select desired Excel file (from completed sample run) and click OK button. Click OK button in “ODBC Microsoft Excel Setup” dialog box.
5. Click OK button in “ODBC Data Source Administrator” dialog box to close box and return to desktop main menu. This step completes the link to database file containing data from sampling run.
6. Double-click on the ScanSeek icon on laptop or personal computer or laboratory computer system to display the “ScanSeek Data Exchange” dialog

box. All *Data Exchanges* configured for use on the handheld computer are listed in the “Active/Data Exchange Name” box. Place a check in box for selected *Data Exchange* (e.g., DAY1, DAY2, DAY3, DDAY1, DDAY2, etc.). If selected *Data Exchange* does not work properly or is not listed, please refer to SCMP-012 procedures II.B. to reconfigure an existing *Data Exchange* or add a new *Data Exchange*.

7. Place Palm handheld computer into cradle or attach serial/charge cable from the laptop or personal computer or laboratory computer.
8. Press HotSync button on front of cradle or tap HotSync icon on main menu screen of handheld computer. (Note: HotSync progress window should appear on desktop, and a similar screen should display on handheld computer.) Wait for software to display message indicating synchronization is complete. If transfer of *Data Exchange* does not occur, view detailed information on HotSync process to correct problems or refer to the HotSync chapter in Product Reference Guide.

C. Transferring Electronic Data from Central Office Staff to Laboratory Computer System

1. **Central office staff:** at the laboratory receiving area, check populated spreadsheet for transcription errors, spelling errors, missing information, or unusual spaces in front of character information. Review all dates and times for accuracy, lab accession numbers for consecutiveness, and bottle numbers for proper codes and scanning sequence. After review, print two copies and have each participating field staff review for accuracy. If any modifications, additions, or deletions are necessary, make changes in the Excel file and save. In the event of information transmittal failure, backup hand written field sheets are to be used to provide information to the laboratory. Reprint two copies for each run sheet if necessary. Sampling staff and receiving laboratory staff must sign two copies of each run sheet for chain-of-custody purposes (see SCMP-006).
2. Click toolbar button labeled “Stream Network” or “Special Study.” The stream chemistry run Excel spreadsheet is automatically converted to a comma-delimited file and electronically logs samples into the laboratory data collection system. The laboratory DocuWare Document Management System automatically begins applying the lab accession number to the upper right corner of individual field collection worksheets, based on the set and types of submitted samples. The purpose of this feature is to provide a hard copy to analysts in each component (inorganic, organic, microbiology, radiological) laboratory for completion of requested analyses. A DocuWare progress window should appear on desktop. Wait for software to display message indicating that data transfer is completed. Close Excel, and a

message should immediately indicate that a file name “C:/transfer/stream network.csv” already exists in this location. A prompt will appear “Do you want to replace it?” Click “Yes” return to desktop. Click the “Safely Remove Hardware” icon located in the System Tray line on desktop. A prompt will appear “Select the device to unplug?” Select “Mass Storage Device-Drive (F:)” and click “Stop” and remove USB flash drive. Upon return to home office, transfer USB flash drive to stream chemistry program manager or a designated person. The manger (or designee) will upload data into an electronic tracking file that records the number and type of samples submitted to the laboratory for analysis.

D. Uploading Stream Chemistry Data into Laboratory Data Collection System

At this point, KHEL has official custody of sample run data. Although field collection staff have no direct jurisdiction over entry of the data into laboratory system, they can and, on occasion do, provide assistance to the laboratory central receiving staff. The following steps are implemented by either laboratory or field staff process:

1. From laboratory computer terminal, click on Stream-Netw Informix Database Source icon to display “Establish a Connection” and prompt for user password. Type current password and click OK. When the Env Master Menu tabs appear at the top of the screen, select Stream Network tab or Special Project tab.
2. A message should appear indicating the number of stations accepted by the program. At the prompt, type “Y” and hit ENTER to continue.
3. At the next prompt, type “Y” and hit ENTER. A message will appear indicating “Chem Labels Printed . . . Enter any key to Continue.” This process will continue for “TOC,” “DO,” “NUTRIENT,” “ENVIR MICRO,” “PESTICIDES,” “RADATION,” and “TRITIUM” bottle labels. These labels display both bottle numbers and lab accession numbers. Once all the labels have been printed, the program will indicate “demographics added...” and “stream samples added...” and will terminate. Log off system after generating barcodes.
4. Sample laboratory receiving personnel affix printed labels to sequenced bottles by matching bottle number with label and bottle number with laboratory accession number. Lab labels are applied universally on all bottles near neck area so analyst can double check for accuracy when sequencing for sample analysis.
5. After affixing and correlating generated barcodes to submitted sample bottles, laboratory personnel distribute samples and field collection worksheets to component laboratories at KHEL for analysis.

**APPENDIX C**

**STANDARDIZED FIELD SHEETS AND**

**SAMPLE SUBMISSION FORMS**

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Electronic Network Run Template B Laboratory Sample Submission Form with Chain-of-Custody Block (Form APP.C-2) . . . . .	0	02/05/07
Electronic Network Run Laboratory Sample Submission Form with QA/QC Stations Added and Chain-of-Custody Block (Form APP.C-3) . . . . .	0	02/05/07
Electronic Network Run Viewed on Handheld Computer Displaying Individual Station Record (Form APP.C-4) . . . . .	0	02/05/07
Handwritten Backup Network Run Field Sheet Laboratory Sample Submission Form with Chain-of-Custody Block (Form APP.C-5) . . . . .	2	02/05/07
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FORM APP.C-1

ELECTRONIC NETWORK RUN TEMPLATE A  
LABORATORY SAMPLE SUBMISSION  
FORM WITH CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT DIVISION OF ENVIRONMENT DATA FORM																
PROJECT: NORTHEAST RUN																
STA	LOCATION	LAB ACCESS	FIELD DATE	CHEM	TOC	H/M	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	FLOW CONDITION	COLLECTOR
SC554	Delaware River near Half Mound										NO	NO				
SC201	Wolf River near Sparks										NO	NO		CH - a		
SC292	Walnut Creek near Reserve										NO	NO				
SC291	Pony Creek near Reserve										NO	NO				
SC234	South Fork Nemaha River near Bern									NO	NO	NO				
SC801	Turkey Creek near Bern									NO	NO	NO				
SC682	South Fork Nemaha River near Seneca									NO	NO	NO				

CHAIN OF CUSTODY			
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received for lab by: (Signature)	Date / Time

FORM APP.C-2

ELECTRONIC NETWORK RUN TEMPLATE B  
LABORATORY SAMPLE SUBMISSION FORM  
WITH CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT DIVISION OF ENVIRONMENT DATA FORM																
PROJECT: NORTHEAST RUN																
STA	LOCATION	LAB ACCESS	FIELD DATE	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	FLOW CONDITION	COLLECTOR
SC554	Delaware River near Half Mound									NO	NO	NO				
SC201	Wolf River near Sparks									NO					CH - a	
SC292	Walnut Creek near Reserve									NO						
SC291	Pony Creek near Reserve									NO						
SC234	South Fork Nemaha River near Bem										NO	NO				
SC601	Turkey Creek near Bem										NO	NO				
SC682	South Fork Nemaha River near Seneca										NO	NO				

CHAIN OF CUSTODY			
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received for lab by: (Signature)	Date / Time

FORM APP.C-3

ELECTRONIC NETWORK RUN  
LABORATORY SAMPLE SUBMISSION FORM  
WITH QA/QC STATIONS ADDED  
AND CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT DIVISION OF ENVIRONMENT DATA FORM																
PROJECT: NORTHEAST RUN																
STA	LOCATION	LAB ACCESS	FIELD DATE	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	FLOW CONDITION	COLLECTOR
SC554	Delaware River near Half Mound	446819								NO	NO	NO				Stahl / Gutierrez
SC201	Wolf River near Sparks	446820								NO					Chl - a	Stahl / Gutierrez
SC292	Walnut Creek near Reserve	446821								NO						Stahl / Gutierrez
SC291	Pony Creek near Reserve	446822								NO						Stahl / Gutierrez
SC234	South Fork Nemaha River near Bern	446823									NO	NO				Stahl / Gutierrez
SC801	Turkey Creek near Bern	446824									NO	NO				Stahl / Gutierrez
SC682	South Fork Nemaha River near Seneca	446825									NO	NO				Stahl / Gutierrez
SC234	South Fork Nemaha River near Bern Duplicate	446826									NO	NO		Duplicate		Stahl / Gutierrez
SC000	Q C Sample	446827									NO	NO				Stahl / Gutierrez

CHAIN OF CUSTODY			
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received for lab by: (Signature)	Date / Time

FORM APP.C-4

ELECTRONIC NETWORK RUN  
VIEWED ON HANDHELD COMPUTER  
DISPLAYING INDIVIDUAL STATION RECORD



FORM APP.C-5

HANDWRITTEN BACKUP NETWORK RUN FIELD SHEET  
LABORATORY SAMPLE SUBMISSION FORM  
WITH CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT DIVISION OF ENVIRONMENT DATA FORM																
PROJECT: NORTHEAST RUN																
STA.	LOCATION	LAB. ACCESS	FIELD DATE	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	FLOW CONDITION	COLLECTOR
SC554	Delaware River near Half Mound	445819	8:08	4002	3427	3629	3195	3371	3891	NO	NO	NO	9	7.8	A-C	Stahl / Gutierrez
SC201	Wolf River near Sparks	445820	9:32	0791	3428	3636	3196	3372	3900	NO	0041	0155	10	8.1	A-C CH-a = 0%	Stahl / Gutierrez
SC262	Walnut Creek near Reserve	445821	10:43	0960	3429	3635	3171	3373	3902	NO	0021	0002	12	8.0	A-C	Stahl / Gutierrez
SC291	Pony Creek near Reserve	445822	11:03	0797	3392	3634	3172	3374	3901	NO	0020	0156	12	8.3	A-C	Stahl / Gutierrez
SC234	South Fork Nemaha River near Bern	445823	11:59	0792	3396	3640	3173	3374	3909	2054	NO	NO	14	8.3	A-C	Stahl / Gutierrez
SC601	Turkey Creek near Bern	445824	12:18	4004	3410	3531	3247	3335	3899	1713	NO	NO	14	8.3	A-C	Stahl / Gutierrez
SC682	South Fork Nemaha River near Seneca	445825	13:20	4000	3400	3527	3249	3333	3898	1711	NO	NO	17	8.3	A-C	Stahl / Gutierrez
SC234	South Fork Nemaha River near Bern Duplicate	445826	12:04	4001	3399	3633	3191	3377	3910	2054	NO	NO	14	8.3	A-C	Stahl / Gutierrez
SC000	Q.C. Sample	445827	12:23	4003	3395	3523	3249	3332	3893	1712	NO	NO	15	6.3	Duplicate 11-28-05 6DL #4	Stahl / Gutierrez

CHAIN OF CUSTODY			
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received for lab by: (Signature)	Date / Time

FORM APP. C-6

FINAL ELECTRONIC NETWORK RUN  
LABORATORY SAMPLE SUBMISSION FORM  
WITH COMPLETED CHAIN-OF-CUSTODY BLOCK

KANSAS DEPARTMENT OF HEALTH AND ENVIRONMENT DIVISION OF ENVIRONMENT DATA FORM																
PROJECT: NORTHEAST RUN																
STA.	LOCATION	LAB. ACCESS	FIELD DATE	CHEM	TOC	HM	DO	NH3	BACT	PEST	RAD	TRIT	TEMP	FIELD pH	FLOW/CONDITION	COLLECTOR
SC554	Delaware River near Half Mound	445819	4/27/2005 8:08	4002CM	3427TC	3529HM	3195DO	3371NT	3891BC	NO	NO	NO	9	7.8	Average/clear	Stahl / Gutierrez
SC201	Wolf River near Sparks	445820	4/27/2005 9:32	0791CM	3428TC	3639HM	3196DO	3372NT	3900BC	NO	0041RD	0155TT	10	8.1	CH - a 10% average/clear	Stahl / Gutierrez
SC292	Walnut Creek near Reserve	445821	4/27/2005 10:43	0800CM	3429TC	3639HM	3171DO	3373NT	3900BC	NO	0021RD	0002TT	12	8.0	Average/clear	Stahl / Gutierrez
SC291	Pony Creek near Reserve	445822	4/27/2005 11:03	0790CM	3392TC	3634HM	3172DO	3374NT	3901BC	NO	0020RD	0156TT	12	8.3	Average/clear	Stahl / Gutierrez
SC234	South Fork Nemaha River near Bern	445823	4/27/2005 11:59	0790CM	3396TC	3640HM	3173DO	3375NT	3900BC	2056OC	NO	NO	14	8.3	Average/clear	Stahl / Gutierrez
SC501	Turkey Creek near Bern	445824	4/27/2005 12:18	4004CM	3410TC	3531HM	3247DO	3335NT	3890BC	1713OC	NO	NO	14	8.3	Average/clear	Stahl / Gutierrez
SC582	South Fork Nemaha River near Seneca	445825	4/27/2005 13:20	4000CM	3400TC	3527HM	3249DO	3333NT	3898BC	1711OC	NO	NO	17	8.3	Average/clear	Stahl / Gutierrez
SC234	South Fork Nemaha River near Bern Duplicate	445826	4/27/2005 12:04	4001CM	3399TC	3633HM	3191DO	3377NT	3910BC	2054OC	NO	NO	14	8.3	Duplicate	Stahl / Gutierrez
SC000	Q.C. Sample	445827	4/27/2005 12:23	4003CM	3395TC	3523HM	3248DO	3332NT	3893BC	1712OC	NO	NO	15	8.3	STA 234/GDW 4/4-12-05	Stahl / Gutierrez

CHAIN OF CUSTODY			
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received by:	
Received by: (Signature)	Date / Time	Received for lab by: (Signature)	Date / Time
<i>A. J. Stahl</i>	4/27/05 15:30	<i>Amy Tryon</i>	04/27/05

DIV. OF H&E  
LABORATORIES  
2005 APR 27 PM 3: 46

## **APPENDIX D**

## **REFERENCES**

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## **APPENDIX E**

### **GLOSSARY OF TERMS**

## GLOSSARY OF TERMS

**accuracy** -- the extent to which a measured value actually represents the condition being measured. Accuracy is influenced by the degree of random error (precision) and systematic error (bias) inherent in the measurement operation (e.g., environmental sampling and analytical operations).

**activity** -- an all inclusive term describing a specific set of operations or related tasks to be performed, either serially or in parallel (e.g., research and development, field sampling, analytical operations), that in total result in a product or service.

**assessment** -- the evaluation process used to measure the performance or effectiveness of a system and its elements. As used in this program QA management plan, “assessment” is an all-inclusive term used to denote audits, performance evaluations, management system reviews, internal reviews and related actions.

**audit** -- a systematic and independent examination to determine whether quality activities and related results comply with planned arrangements and whether these arrangements are implemented effectively and are suitable to achieve objectives.

**automated external defibrillator (AED)**-- a portable, battery powered lifesaving device employed by trained individuals in medial emergencies to correct a chaotic heart rhythm in an ill or injured person by subjecting the heart of said person to a controlled electrical shock.

**bias** -- the systematic or persistent distortion of a measurement process which causes errors in one direction (i.e., the degree to which the expected sample measurement is different from the true sample value).

**calibration** -- a comparison of a measurement standard, instrument, or item with a standard, instrument or item of higher accuracy to detect, quantify and report inaccuracies and to eliminate these inaccuracies through adjustments.

**censored data** -- a dataset containing data points whose measured properties are not present in an amount that can be reliably quantified and therefore accorded a specific code.

**chain of custody** -- an unbroken trail of accountability that ensures the physical security of samples, data and records.

**comparability** -- a measure of the confidence with which one item (e.g., data set) can be compared to another.

**completeness** -- a measure of the amount of valid data obtained from a measurement system compared to the amount that was expected to be obtained under normal conditions.

**computer program** -- a sequence of instructions suitable for processing by a computer. Processing may include the use of an assembler, compiler, interpreter, or translator to prepare the program for execution. A computer program may be stored on electrical, magnetic or optical media.

**concurrent duplicate** -- a surface water quality sample that is arbitrarily split by filling separate sample containers concurrently from the same sampling device to assess sample homogeneity in the sample collection process.

**container blank** -- a clean water sample (e.g., distilled water) transferred directly to a randomly selected sample container in order to assess or monitor contamination resulting from sample containment.

**corrective action** -- any measure taken to rectify a condition adverse to quality and, if possible, to preclude its recurrence.

**data performance criteria** -- qualitative and quantitative statements that define the appropriate type of data and/or specify tolerable levels of potential decision errors. These criteria establish the quality and quantity of data needed to support decisions.

**data quality assessment** -- a scientific and statistical evaluation of a set of environmental data to determine the adequacy of the data for its intended use.

**deficiency** -- an unauthorized deviation from acceptable procedures or practices.

**detection limit** -- the lowest concentration of a target analyte that a given method or instrument can reliably ascertain and report as greater than zero.

**document** -- any written or pictorial information describing, defining, specifying, reporting or certifying activities, requirements, procedures or results.

**duplicate samples** -- paired samples collected at essentially the same time from the same site and carried through all assessment and analytical procedures in an identical manner. Duplicate samples are used to measure natural variability as well as the precision of a method, monitoring instrument, and/or analyst. More than two such samples are referred to as replicate samples.

**ecoregion** -- an ecologically distinctive geographical area, defined in the context of scale by a combination of landscape features such as climate, physiography, soils, vegetation or potential vegetation, geology, and land use.

**environmental data** -- the description of a physical medium (e.g., air, water, soil, sediment) or biological system expressed in terms of some measurable physical, chemical, radiological or biological characteristic or set of characteristics.

**environmental monitoring program** -- a planned and systematic operation for characterizing an environmental process or condition. For the purposes of this document, the term “program” refers to a major, ongoing or longer term environmental monitoring operation.

**environmental monitoring project** -- a planned and systematic operation for characterizing an environmental process or condition. For the purposes of this document, the term “project” refers to a smaller scale or shorter term environmental monitoring operation.

**field blank** -- a clean sample (e.g., distilled water) that is treated the same as samples collected in the field. Field blanks are submitted to the analyst along with other samples and are used to detect and quantify contamination incurred during sample collection, transport, storage, and analysis.

**field spike** -- a spiked sample prepared in the field. See spiked sample.

**holding time** -- an agreed upon, maximum interval of time in which a sample can be held under prescribed preservation methods.

**independent assessment** -- a quality assessment of an environmental monitoring program, project or system performed by a qualified individual, group, or organization that is not part of the program, project or system.

**inspection** -- examination or measurement of an activity to verify conformance with specific requirements.

**internal assessment** -- any quality assessment of the work performed by an individual, group, or organization, conducted by those overseeing and/or performing the work.

**method** -- a body of procedures for performing an activity in a systematic and repeatable manner.

**method reporting limit (MRL)**-- a minimum concentration of an analyte that can be measured within laboratory specified limits of precision and accuracy (cf., reporting limit ).

**nonparametric statistics** -- procedures for organizing and interpreting numerical data that are free of any assumptions about the data distribution and do not require estimation of the variance, mean or other population parameters.

**open database connectivity (ODBC)**-- a computer interface that provides a seamless connection between a database-independent application and a target database.

**parametric statistics** -- procedures for organizing and interpreting numerical data that employ certain assumptions about the data distribution and require estimation of at least one population parameter.

**peer review** -- a critical review of a finding or document conducted by qualified individuals other than those who produced the finding or document but collectively equivalent in technical expertise.

**performance evaluation** -- a type of audit in which the quantitative data generated in a measurement system are obtained independently and compared with routinely obtained data to evaluate the proficiency of a technician, analyst or laboratory.

**precision** -- the level of agreement among individual measurements of the same property, conducted under identical or similar conditions.

**qualified data** -- data that have been modified, adjusted or flagged in a data base following data validation procedures.

**quality** -- those features of a product or service that bear on its ability to meet the stated or implied needs and expectations of the user.

**quality assurance (QA)** -- an integrated system of management activities involving planning, implementation, assessment, reporting, and quality improvement to ensure that a process, item or service is of the type and quality needed and expected by the user.

**quality control (QC)** -- the overall system of technical activities that measures the attributes and performance of a process, item or service against defined standards to verify that the process, item or service meets the stated requirements of the user.

**quality management plan (QMP)** -- a formal document that describes a quality management system in terms of the organizational structure, functional responsibilities, and planning, implementation and assessment of work.

**record** -- a document or portion thereof furnishing evidence of the quality of an item or activity, validated and authenticated as technically complete and correct. Records may include reports, photographs, drawings, and data stored on electronic, magnetic, optical or other recording media.

**reference site** -- a monitored site (e.g., stream location or segment) that is little impacted by urban, industrial or agricultural development or any other human enterprise. Reference sites serve as points of comparison for assessing the extent of human impact on the ecological integrity of other sites in the same geographical area, drainage basin, or ecoregion.

**relative percent difference (RPD)** -- a value calculated by subtracting the lower of two duplicate analyses from the higher, then dividing this difference by the average of the two analyses and multiplying the result by 100 to convert to percent difference.

**replicate sample** -- see duplicate sample.

**reporting limit** -- the lowest (or highest) concentration (or level) of a parameter that can be reliably reported by an individual analyst or laboratory based on the applied analytical method and instrumentation, the ability of the analyst or laboratory, and the effort devoted to the analytical determination.

**representativeness** -- a measure of the degree to which data accurately and precisely represent a selected characteristic of a monitored system.

**reproducibility** -- a measure of the degree to which sequential or repeated measurements of the same system vary from one another, independently of any actual change in the system.

**sensitivity** -- a measure of the capacity of an analytical method or instrument to discriminate between different levels of a variable of interest.

**sequential duplicate** -- a sequence of separate surface water quality samples (usually two) collected within minutes of each other at a specified location to assess variability among samples resulting from collection, processing, transport, and laboratory preparation and procedures.

**spiked sample** -- a sample of water, air, soil, sediment, biological tissue or other material which is amended by the addition of a known amount of a given chemical element or compound. The measured concentration of the element or compound in the amended material is compared to the measured amount in the unamended material to provide a measure of analytical recovery and accuracy.

**standard operating procedure (SOP)** -- a written, formally approved document that comprehensively and sequentially describes the methods employed in a routine operation, analysis or action.

**technical review** -- a critical review of an operation by independent reviewers collectively equivalent in technical expertise to those performing the operation (cf., peer review).

**thalweg** -- a line defining the lowest points along the length of a stream bed or valley.

**total maximum daily load (TMDL)** -- an estimate of the maximum quantity of a given pollutant that may be added to a surface water body from all sources without violating established water quality criteria, minus a margin of error that accounts for, and corresponds to, the statistical uncertainty inherent in the loading estimate.

**validation** -- the establishment of a conclusion based on detailed evidence or by demonstration. This term is often used in conjunction with formal legal or official actions.